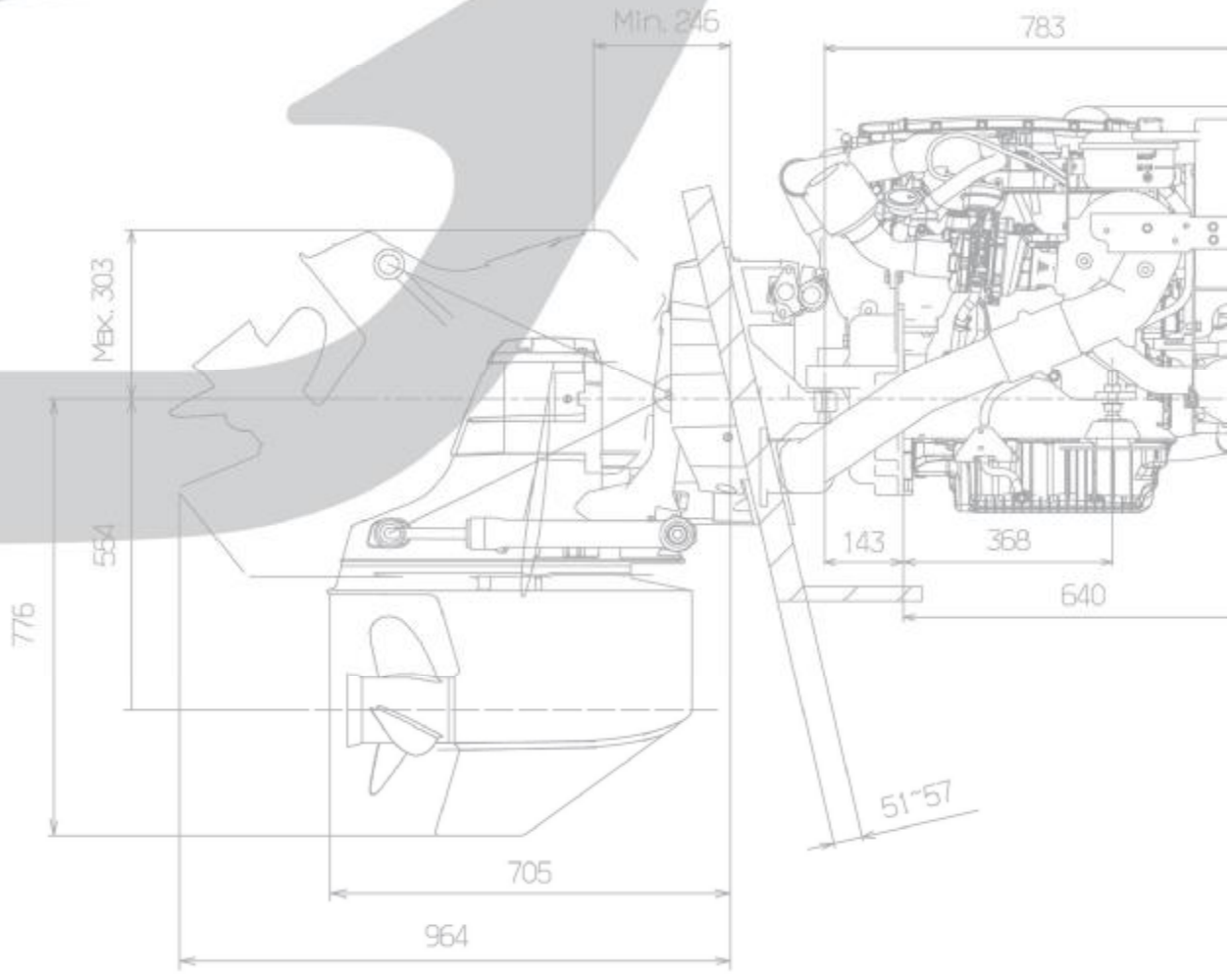
HYUNDAI SEASALL

INSTALLATION & OPERATION MANUAL

D170 & D150 SERIES ENGINES



Applicable to D170S, D170P, D170J, D150S, D150P model

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ABOUT THIS MANUAL

This engine installation and operation manual is provided as guidance for the installation of Hyundai SeasAll engine to a boat, and to describe engine operation. Its purpose is to provide technical information to aid in performing an effective engine installation so as to achieve both maximum performance and service life. For information on installation, operation and maintenance of the ZF Marine Transmissions and Sterndrive Bravo Models, please see the separate booklets included in the original packaging of your Hyundai SeasAll purchase.

Hyundai SeasAll is committed to making clear and accurate information available for those who maintain, own and repair the D170 & D150 Series engines. Hyundai SeasAll values your input regarding revisions and additional information for our manuals.

- The manufacturer is not liable for any damages or losses caused by faulty installation, wrong handling of the equipment and/or deficient maintenance.
- The operator is responsible for the correct and safe operation of the engine and safety of its occupants and general public.
- It is strongly recommended that each operator read and understand this manual before installing and operating the engine.
- This manual as well as safety labels posted on the engine use the following safety alerts to draw your attention to special safety instructions that should be followed.

WARNING

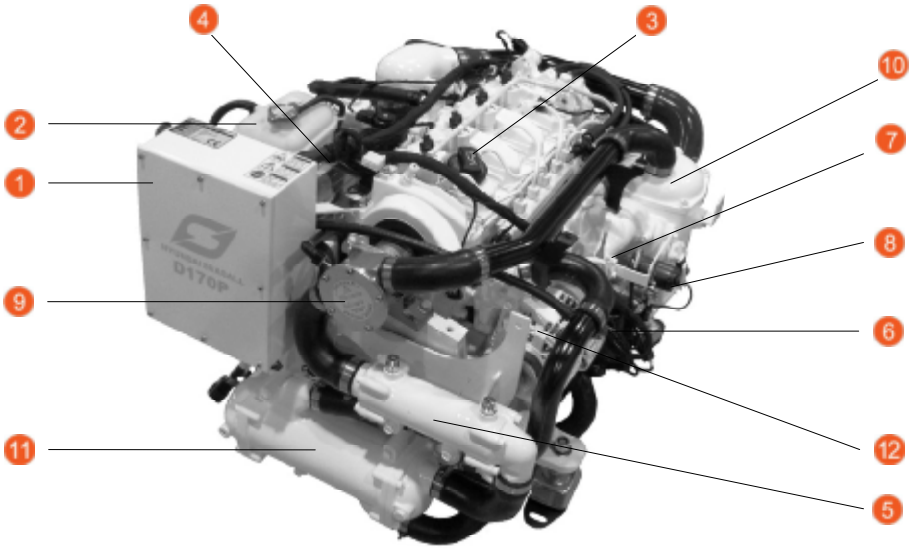
DEVIATION FROM INSTALLATION INSTRUCTIONS AND OPERATION GUIDELINES MAY LEAD TO PERSONAL INJURY OR DEATH TO OPERATORS AND NEARBY PERSONNEL.

CAUTION

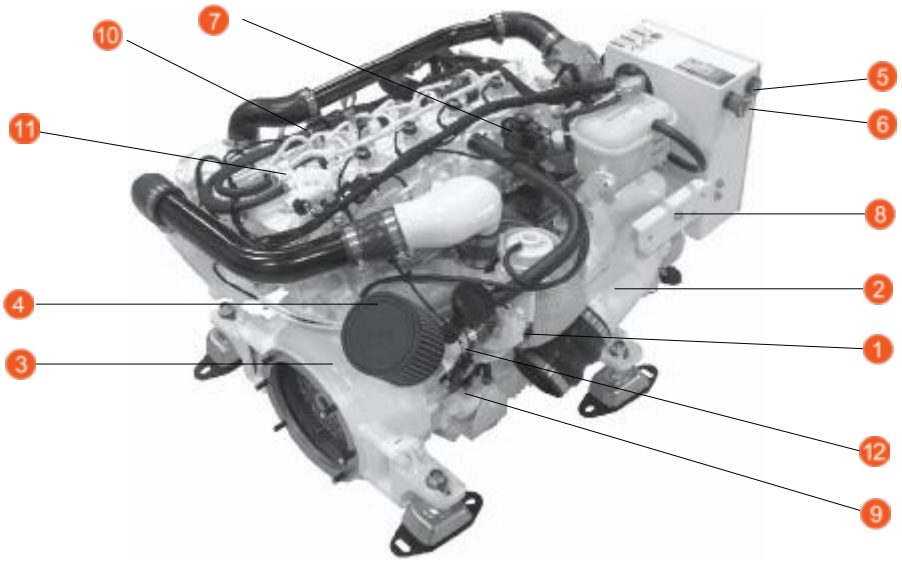
DEVIATION FROM INSTALLATION INSTRUCTIONS AND OPERATION GUIDELINES MAY LEAD TO IMPROPER OPERATION, DAMAGE OR DESTRUCTION OF THE ENGINE.

CHAPTER 1
ENGINE OVERVIEW

1. ENGINE COMPONENTS



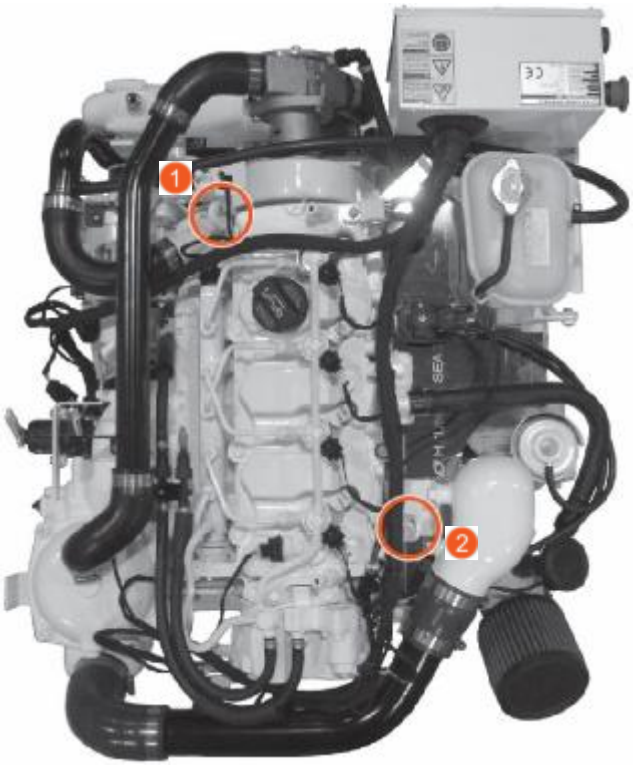
1. ECU Box
2. Coolant Expansion Tank
3. Engine Oil Cap
4. Engine Oil Filter
5. P/S Oil Cooler
6. Fuel Pump
7. Engine Oil Gauge
8. Acceleration Lever Sensor
9. Seawater Pump
10. Intercooler
11. Heat Exchanger
12. Alternator



1. VGT
2. Exhaust Elbow
3. Bell Housing
4. Air Filter
5. Engine Oil Exchange Button
6. Engine Emergency Stop Button
7. VGT Controller
8. Shift Plate
9. Oil Extraction Pump
10. Injector
11. PRV
12. BPS & IATS

2. ENGINE SUSPENSION EYES

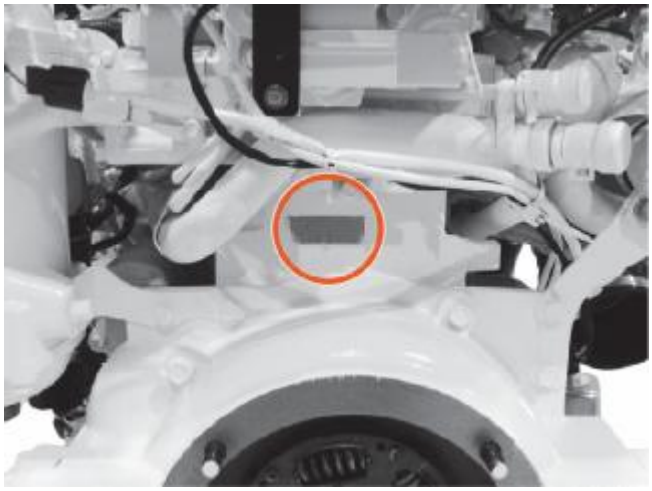
1) To lift the engine, first remove the engine cover. You will find two engine eyes (see figure)
2) To avoid engine damage, take care that engine lift chains or belts do not hit or touch surrounding parts during engine lifting.



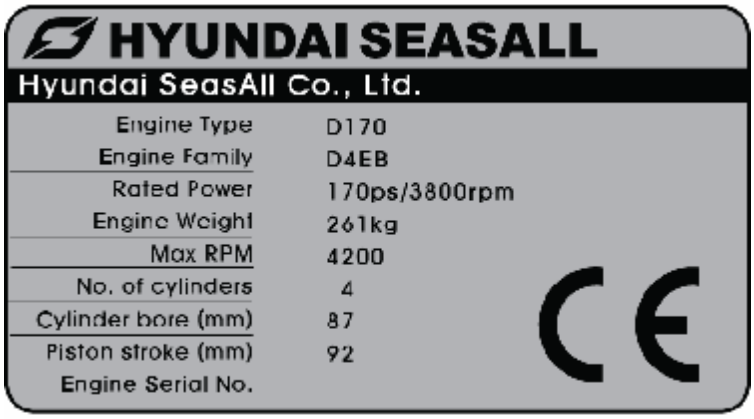
3. ENGINE IDENTIFICATION

Engine identification is affixed to the engine block and the ECU box (see figure).

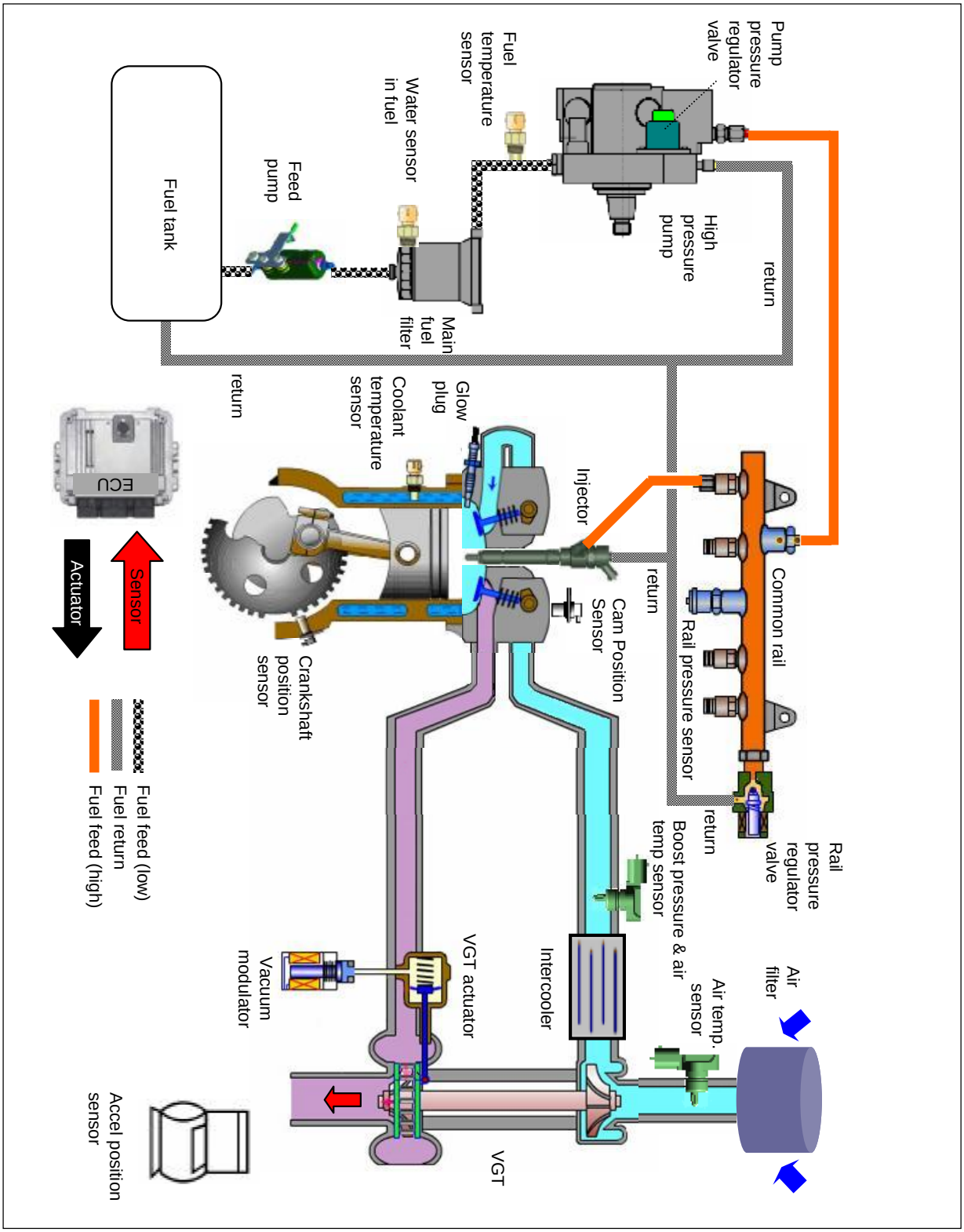
§ SERIAL NUMBER ON THE ENGINE BLOCK



§ NAME PLATE ON THE ECU BOX



4. SCHEMATIC DIAGRAM OF COMMON RAIL DIESEL ENGINE

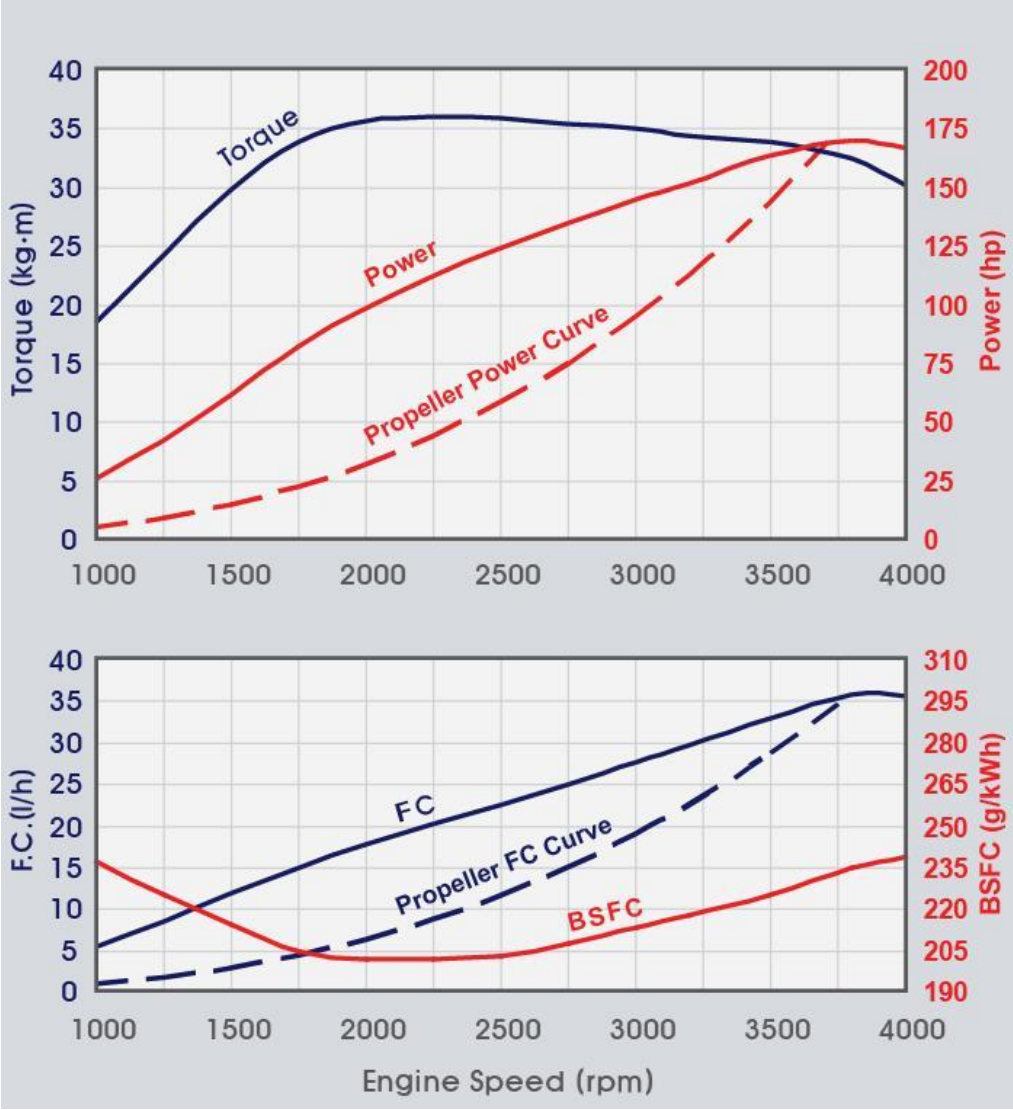


5. TECHNICAL DATA

Engine type	D170 / 150S	D170 / 150P	D170J
	4-stroke, 4-valve		
	After-cooled, direct-injection, water cooling		
Output ps (kW)	170ps (125) / 150ps (110)		
rpm at full load	3800/3200		
Cylinders	I-4		
Ignition sequence	1-3-4-2		
Displacement [cm^3]	2188		
Bore [mm]	87		
Stroke [mm]	92		
Compression ratio	17.3 : 1		
Max. torque [kgm]	36		34
@ speed [rpm]	2000		3500
Injection system	Common rail direct injection		
Diesel fuel	at least CN 51 as per DIN EN 590		
Intake air pressure (abs. bar)	2.5	2.5	2.5
@ speed [rpm]	3800/3200	3800/3200	3800
Coolant quantity (liter)	6.5		
Coolant cap opening pressure (bar)	1.1		
Engine oil (liter)	6		
Engine oil pressure (bar)	2~3 at 1800rpm, 100 ℃(oil temp.)		
Exhaust gas pressure (kPa)	Max. 45		
Alternator [A]	120		
Engine diagnosis	Yes		
Weight (kg)	261		
Battery capacity (AH)	12V, at least 150AH recommended		
Thermostat opening temp. (℃)	85 (starting to open), 95 (fully open)		
Idle rpm warmed up (rev/min)	700		
Permissible eng. oil temp (℃)	135		
Permissible eng. coolant temp (℃)	104		
Propulsion system	Sterndrive	Shaftdrive	Waterjet

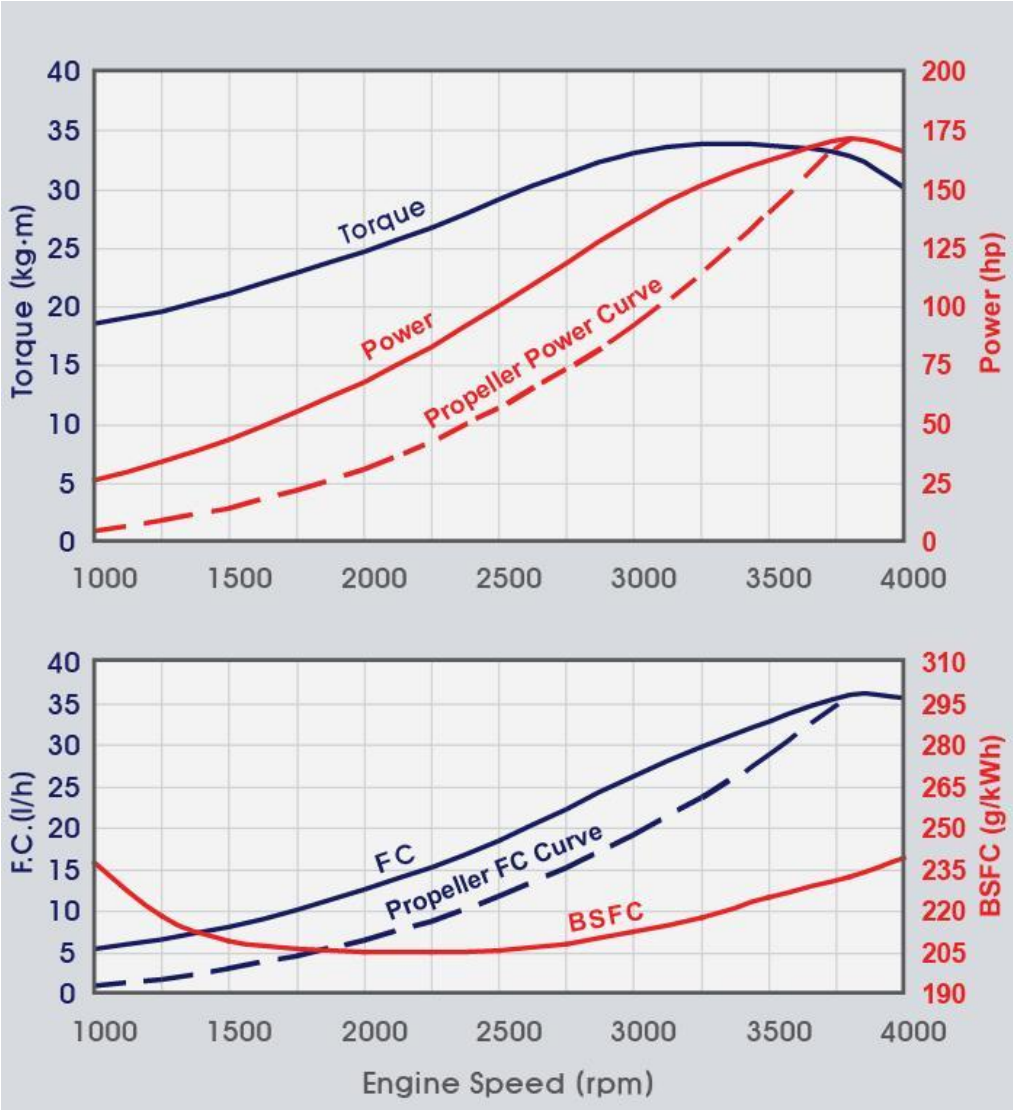
6. PERFORMANCE CURVE

§ D170S & D170P MODEL



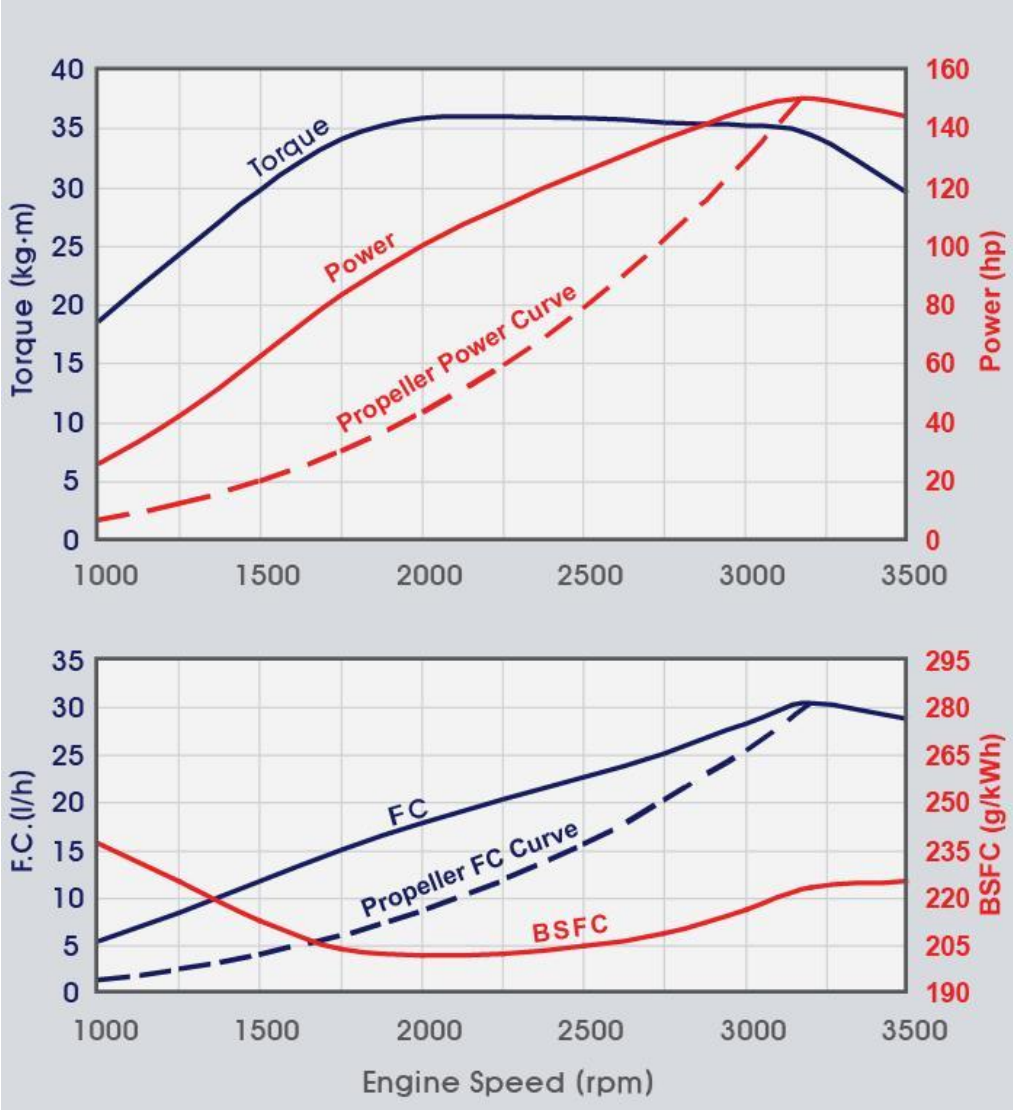
*BSFC : Brake Specific Fuel Consumption *FC : Fuel Consumption

§ D170J MODEL



*BSFC : Brake Specific Fuel Consumption *FC : Fuel Consumption

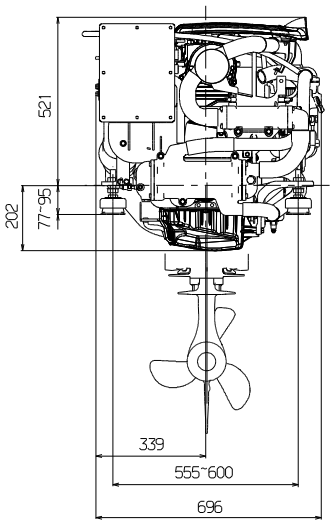
§ D150S & D150P MODEL



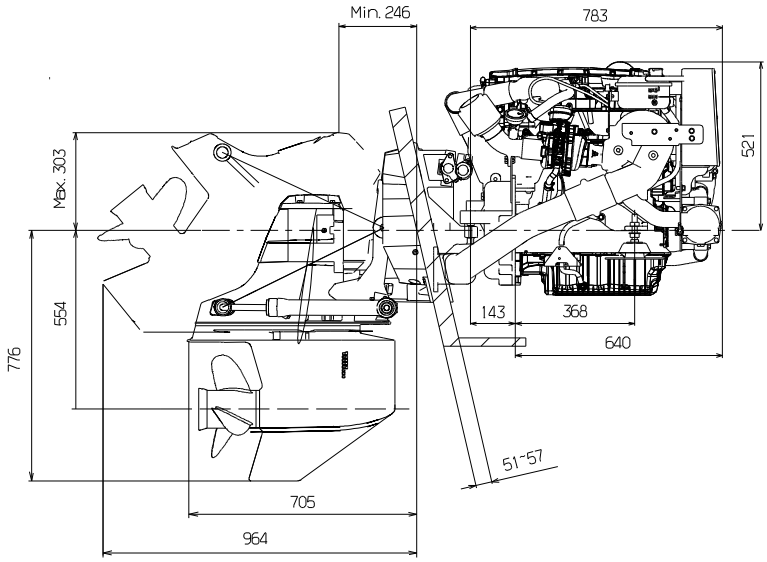
*BSFC : Brake Specific Fuel Consumption *FC : Fuel Consumption

7. ENGINE DIMENSIONS

§ MerCruiser Bravo One X Diesel

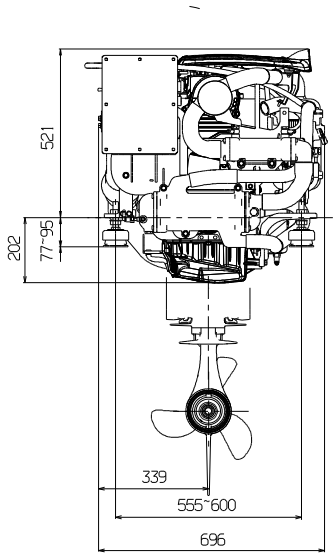


Front view

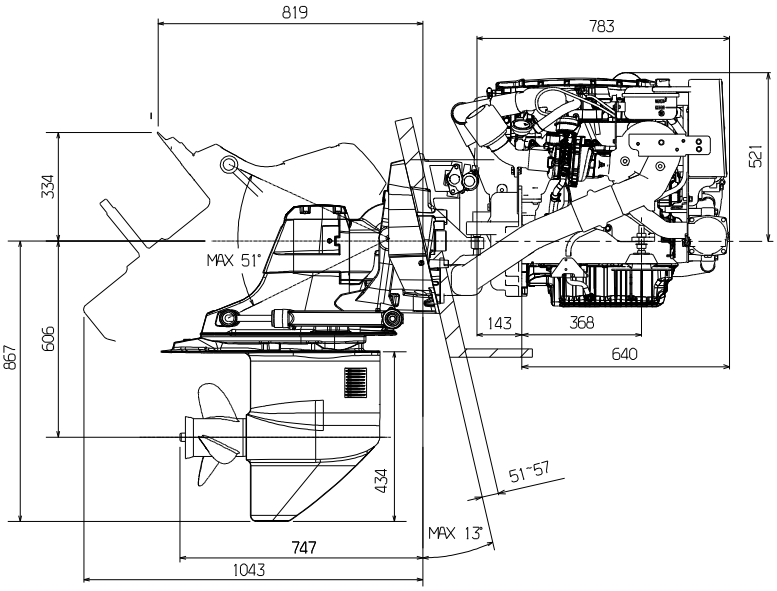


Side view

§ MerCruiser Bravo Two X Diesel

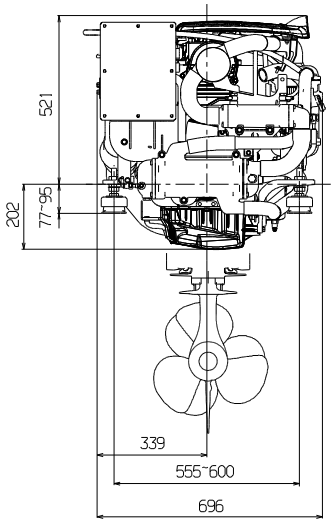


Front view

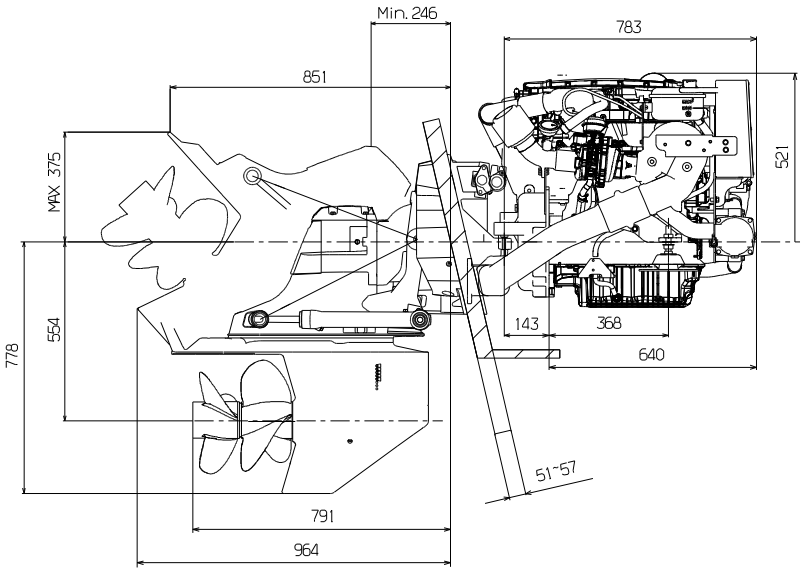


Side view

§ MerCruiser Bravo Three X Diesel

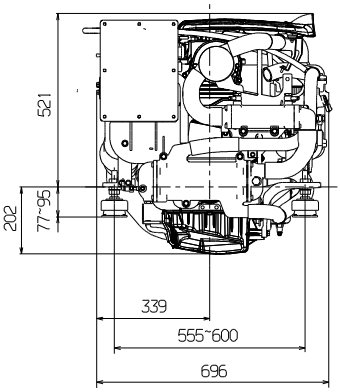


Front view

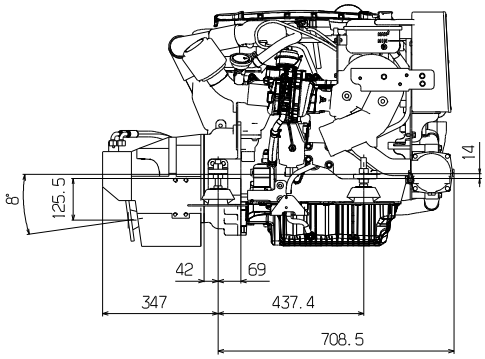


Side view

§ ZF 45 A

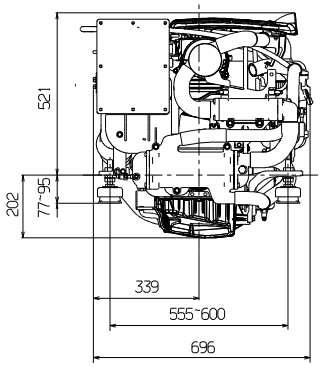


Front view

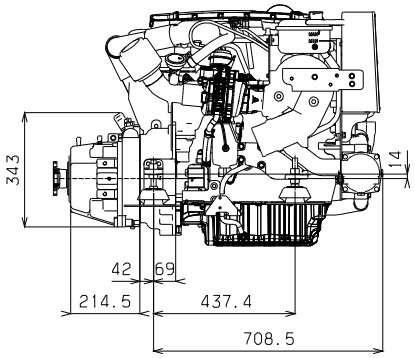


Side view

§ ZF 45 C

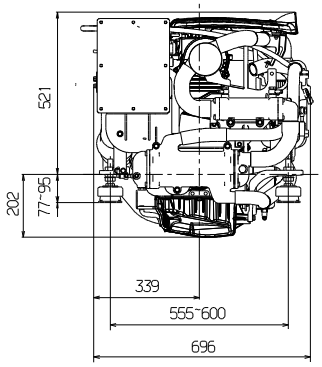


Front view

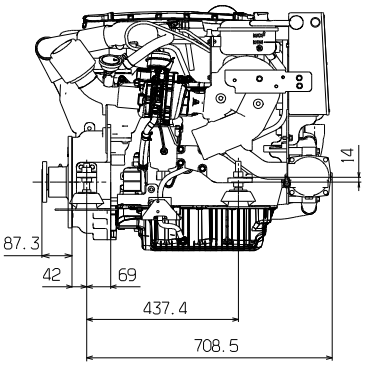


Side view

§ Waterjet adapter without ZF 45C / ZF 63C



Front view



Side view

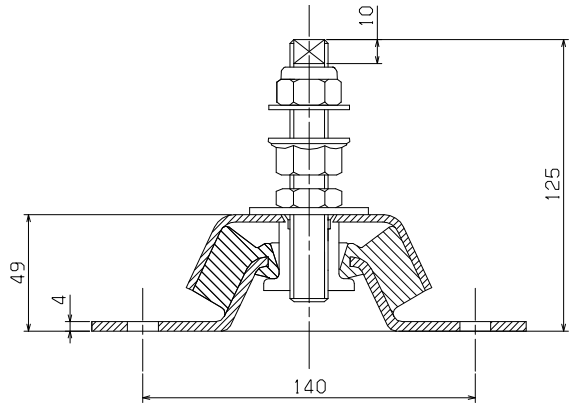
CHAPTER 2
ENGINE MOUNT SYSTEM

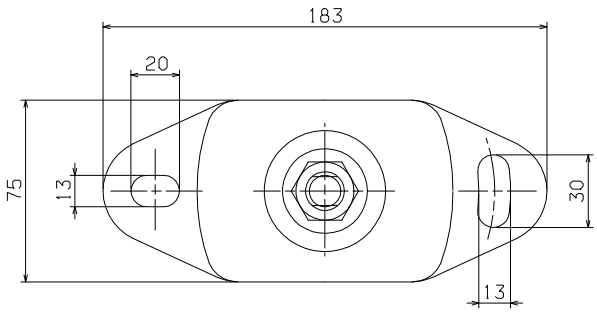
1. ENGINE MOUNTING REQUIRMENTS

§ The mount must be strong enough to carry the loads applied by the weight and power of the engine. It also must be stiff enough that the engine does not sag or move too much when power is applied.

§ The mount must position the engine at the correct height and angle so that the engine's thrust line suits the boat.

2. ENGINE MOUNT DIMENSIONS

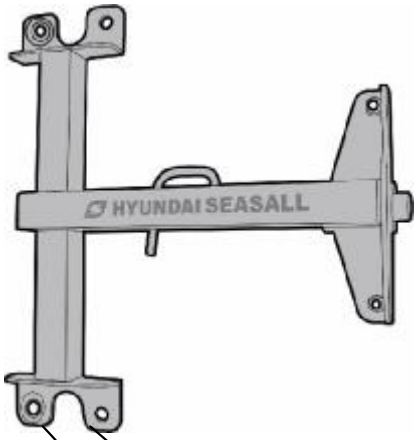




CAUTION

USE ONLY THE ORIGINAL HYUNDAI SeasAll MOUNTINGS THAT WERE SUPPLIED WITH THE INITIAL PURCHASE.
AFTER INSTALLATION AND ALIGNMENT OF THE ENGINE, MAKE SURE THAT NO RESIDUAL TENSION EXISTS IN THE DRIVETRAIN.

3. ENGINE MOUNT TOOL FOR STERNDRIVE MODEL



Mount hole for S250 and S220 model

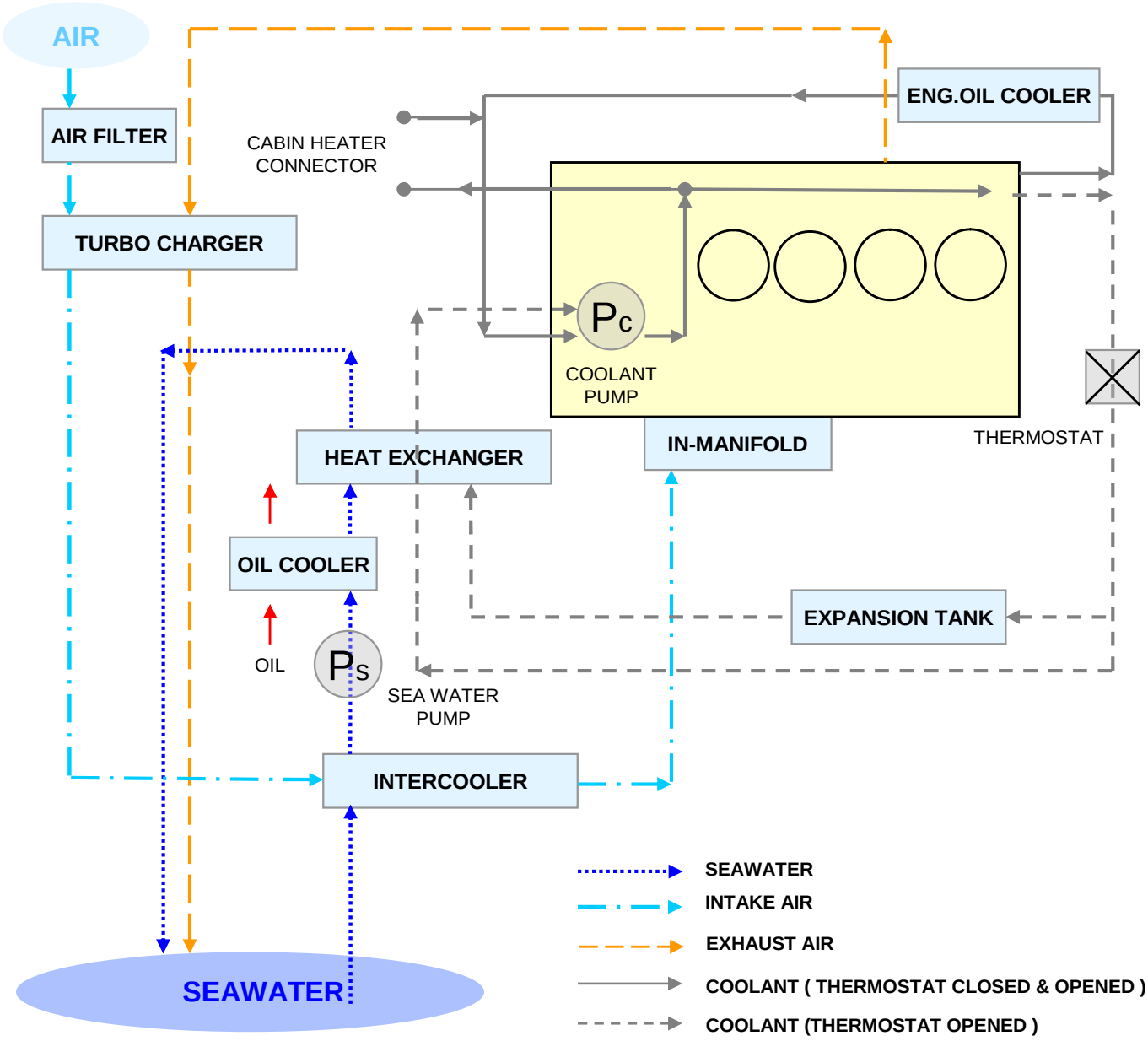
Mount hole for D170 and D150 model

CAUTION

FOR INFORMATION ON INSTALLATION OF THE STERNDRIVE BRAVO MODELS, PLEASE SEE THE SEPARATE BOOKLETS INCLUDED IN THE ORIGINAL PACKAGING OF YOUR HYUNDAI SeasAll PURCHASE. IF IN DOUBT ABOUT ENGINE INSTALLATION, PLEASE CONTACT YOUR NEAREST HYUNDAI SeasAll DEALER.

CHAPTER 3
COOLING & EXHAUST SYSTEM

1. SCHEMATIC DIAGRAM OF ENGINE COOLING CIRCUIT



2. THE FLOW OF SEAWATER – OPEN COOLING CIRCUIT

Water strainer ← Water valve ← Water pickup
↓
① Intercooler
↓
② Seawater pump
↓
③ Oil cooler
↓
④ Heat exchange
↓
⑤ Exhaust elbow
↓
Sea water

2.1 WATER PICKUP

1) Water pickup should be installed in an area where it won't pickup air bubbles and will access fresh water during the duration of engine operation.
2) For use in sterndrive models, please see the section "Installing Sterndrive Seawater Pickup" of the BRAVO MODELS INSTALLATION MANUAL, included in the original packaging.
3) For further safety, you can use an additional transom or bottom type water pickup.

2.2 WATER STRAINER

1) Strainer should be located in an area where it will be easily accessible for periodic seawater flow inspection and cleaning.
2) The size of strainer must be of sufficient capacity to pass the seawater (a flow rate over 150 liters per minute flow rate).
3) Strainer must be installed after water inlet valve in order to allow user to shut off seawater when cleaning strainer filter.

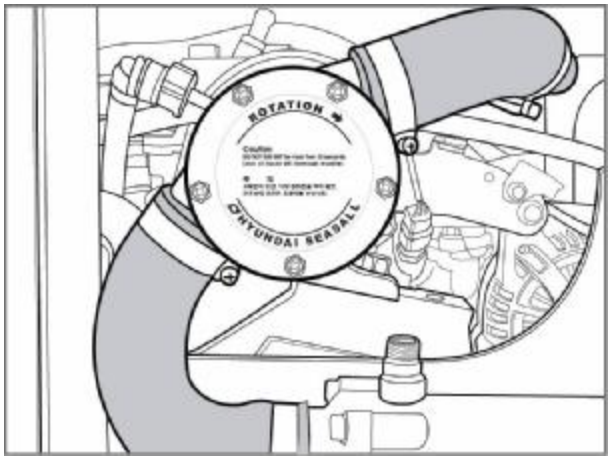
CAUTION

IF ASSEMBLY IS NOT CONDUCTED PROPERLY, AIR CAN BE SUCKED IN, DISTURBING THE VACUUM PROCESS. THIS CAN CAUSE THE ENGINE TO OVERHEAT.

4) To clean strainer filter,

- Stop the engine and close the water valve
- Remove the filter cap
- Remove the filter element, flush it thoroughly with clean water or compressed air
- Insert the cleaned filter element and screw the filter cap
- Check the cap and the gasket for correct seating and sealing
- Open the water valve
- Start the engine and check if there is water leakage

2.3 SEAWATER PUMP



1) The internal diameter of hoses from water pick up to seawater pump inlet should be 40mm.
2) The cross section of hose may shrink due to inlet pressure drop. Therefore, the hose from water pickup in the boat's hull to seawater pump inlet should be as short as possible and must be made of steel wire reinforced material.
3) The seawater pump impeller must be checked periodically and replaced if necessary.
4) To check seawater pump and impeller :
   - Stop the engine and close the water valve
   - Remove the impeller housing cover
   - Remove the impeller from inside the seawater pump
   - Check the condition of impeller and bushing

CAUTION

IF ASSEMBLY IS NOT CONDUCTED PROPERLY, AIR CAN BE SUCKED IN, DISTURBING THE VACUUM PROCESS. THIS CAN CAUSE THE ENGINE TO OVERHEAT.

- Apply soapy water to impeller when assembling, and reassemble towards rotation direction
- Replace of the O-ring on the impeller housing cover
- Open the water valve
- Start the engine and check if there is water leakage

CAUTION

DO NOT RUN THE ENGINE WITHOUT SEAWATER. THE SEAWATER PUMP IMPELLER WILL BE DAMAGED. BEFORE STARTING THE ENGINE, BE SURE TO SUPPLY SEAWATER TO THE PASSAGES.

CAUTION

IMPELLER DAMAGE MAY OCCUR IF APPROPRIATE TOOLS ARE NOT USED WHEN REMOVING THE IMPELLER. MAKE SURE TO CHECK O-RING CONDITION AFTER SEAWATER PUMP REASSEMBLY.

CAUTION

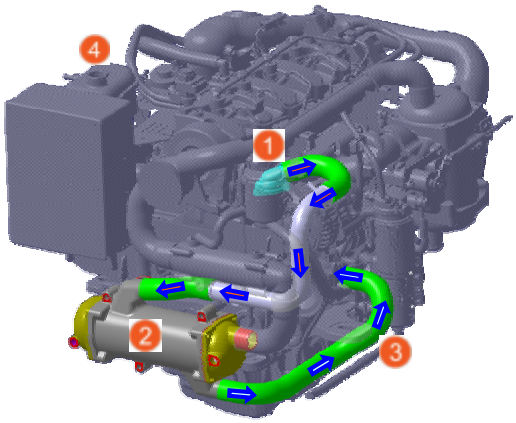
DO NOT INSTALL ADDITIONAL DEVICES WHICH COULD OBSTRUCT THE FLOW OF SEAWATER. THIS CAN CAUSE THE ENGINE TO OVERHEAT.

3. THE FLOW OF ENGINE COOLANT – CLOSED COOLING CIRCUIT

§ THERMOSTAT CLOSED CONDITION

① Coolant engine outlet
↓
Thermostat closed (opening temp 85℃)
↓
② Engine coolant circulation internally

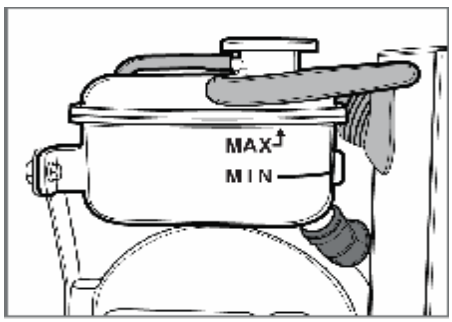
§ THERMOSTAT OPENED CONDITION



① Coolant engine outlet
→ ④ Expansion tank
② Heat exchanger
↓
Thermostat opened (opening temp 85℃)
↓
③ Coolant engine inlet

3.1 ENGINE COOLANT

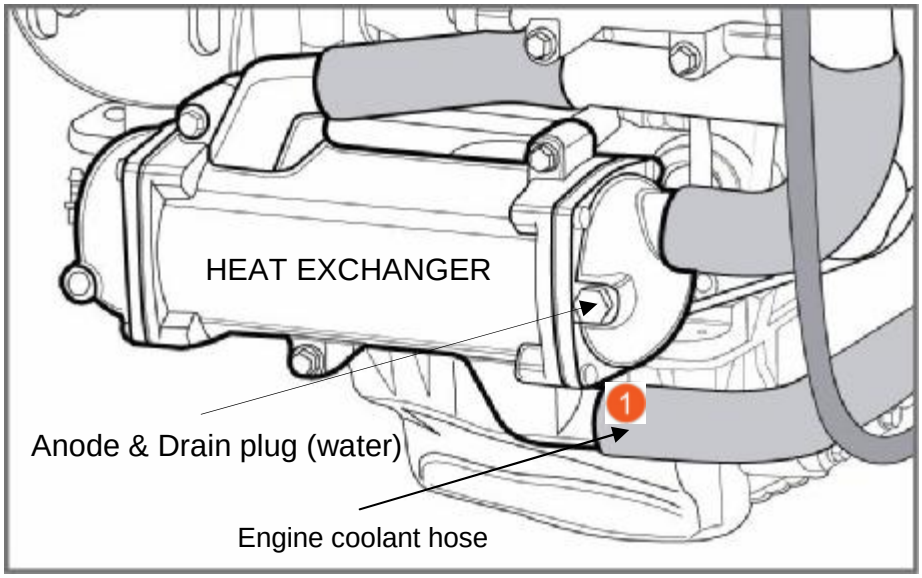
1) The high-pressure cooling system has a reservoir filled with year-round antifreeze coolant. The reservoir is filled at the factory.
2) The coolant level should be between MAX and MIN marks on the side of the coolant reservoir when the engine is cool.



3) If the coolant level is low, add enough specified coolant to provide protection against freezing and corrosion. Bring the level to MAX, but do not overfill.
4) If frequent additions are required, see an authorized dealer for a cooling system inspection.
5) Use only soft (demineralized) water in the coolant mixture.
6) The engine has aluminum engine parts and must be protected by an ethylene-glycol-based coolant to prevent corrosion and freezing.
7) DO NOT USE alcohol or methanol coolant or mix them with the specified coolant.
8) DO NOT USE a solution that contains more than 60% antifreeze or less than 35% antifreeze, which would reduce the effectiveness of the solution.
9) For mixture percentages, refer to the following table:

Ambient Temperature	Mixture Percentage (volume)	
	Antifreeze	Water
-15°C (5°F)	35	65
-25°C (-13°F)	40	60
-35°C (-31°F)	50	50
-45°C (-49°F)	60	40

10) In order to drain engine coolant, please remove clamp and hose① from the heat exchanger
11) when reassemble hose, please exchange old clamp with new one.

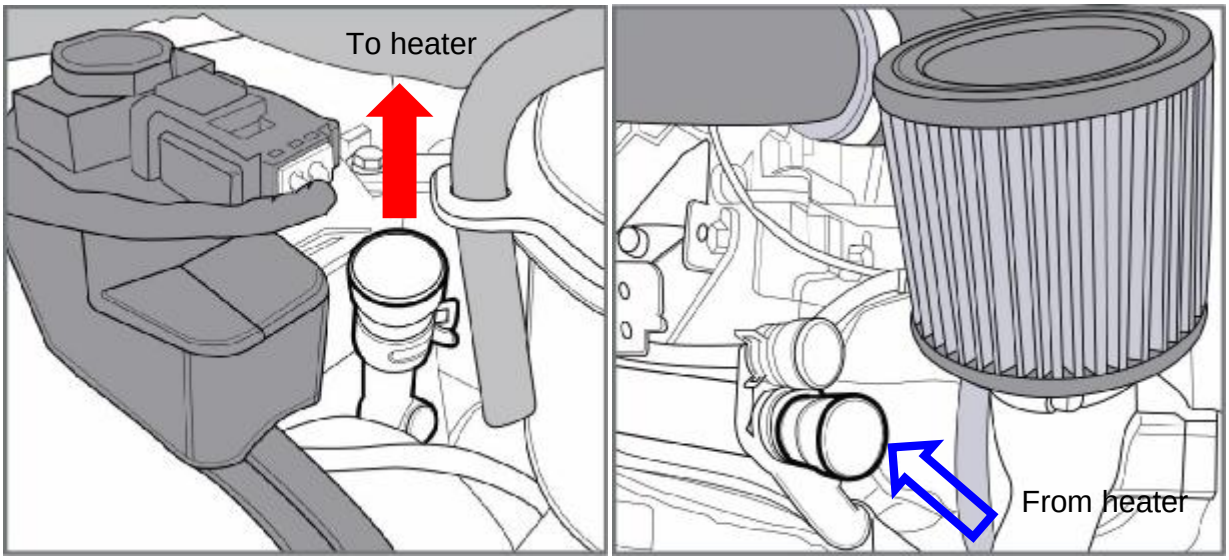


3.2 REMOVING AIR BUBBLES IN COOLANT LINE

1) Start the engine and warm it up at a low rpm (up to thermostat opening)
2) Next, stop the engine and allow the engine to cool enough, and then open the cap of the expansion tank carefully.
   *NOTE: Never open the cap when the engine is hot. Doing so may cause scalding.
3) Refill with coolant if needed.
4) Recap the expansion tank.
5) Please check the level of expansion tank regularly while driving.

3.3 CABIN HEATER CONNECTION

1) In order to use cabin heater, an extra coolant circulation pump is needed.
2) After connecting cabin heater lines, engine coolant must be refilled and checked.
3) Please check coolant flow direction, as shown in figure.
4) If in doubt, please contact your nearest Hyundai SeasAll dealer.



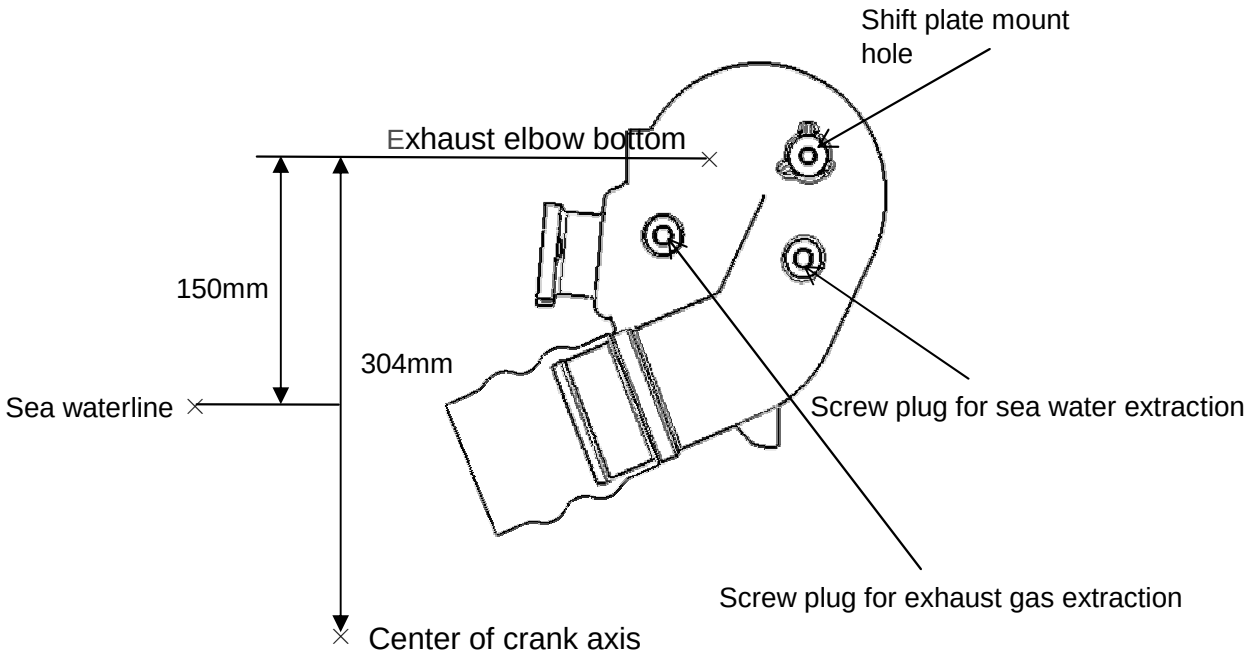
* Outer diameter of line is Ø19.3 mm

WARNING

NEVER OPEN THE EXPANSION TANK CAP WHEN THE ENGINE IS OPERATING OR HOT. IT MAY CAUSE ENGINE DAMAGE AND COULD RESULT IN SERIOUS PERSONAL INJURY.

4. EXHAUST SYSTEM

1) Your Hyundai SeasAll engine's exhaust system consists of a coolant-cooled exhaust manifold and a seawater-cooled exhaust elbow (water injected wet exhaust system).
2) The vessel's exhaust pipe line should not be made too long or to bend. The maximum back pressure of the exhaust gas should be under 350 mbar.
3) Make sure that the shortest height between bottom of the exhaust elbow and the center of the crank axis is 30cm.
4) If the distance between the bottom of the exhaust elbow and the waterline is less than 15cm, or if the waterline is above the water injection point, there is a risk of flowing back (siphoning by engine stopping and outside seawater entering through the transom exhaust hole).
5) In order to avoid this risk, an air ventilation unit and exhaust riser are needed. If in doubt about exhaust system installation, please contact your nearest Hyundai SeasAll dealer.

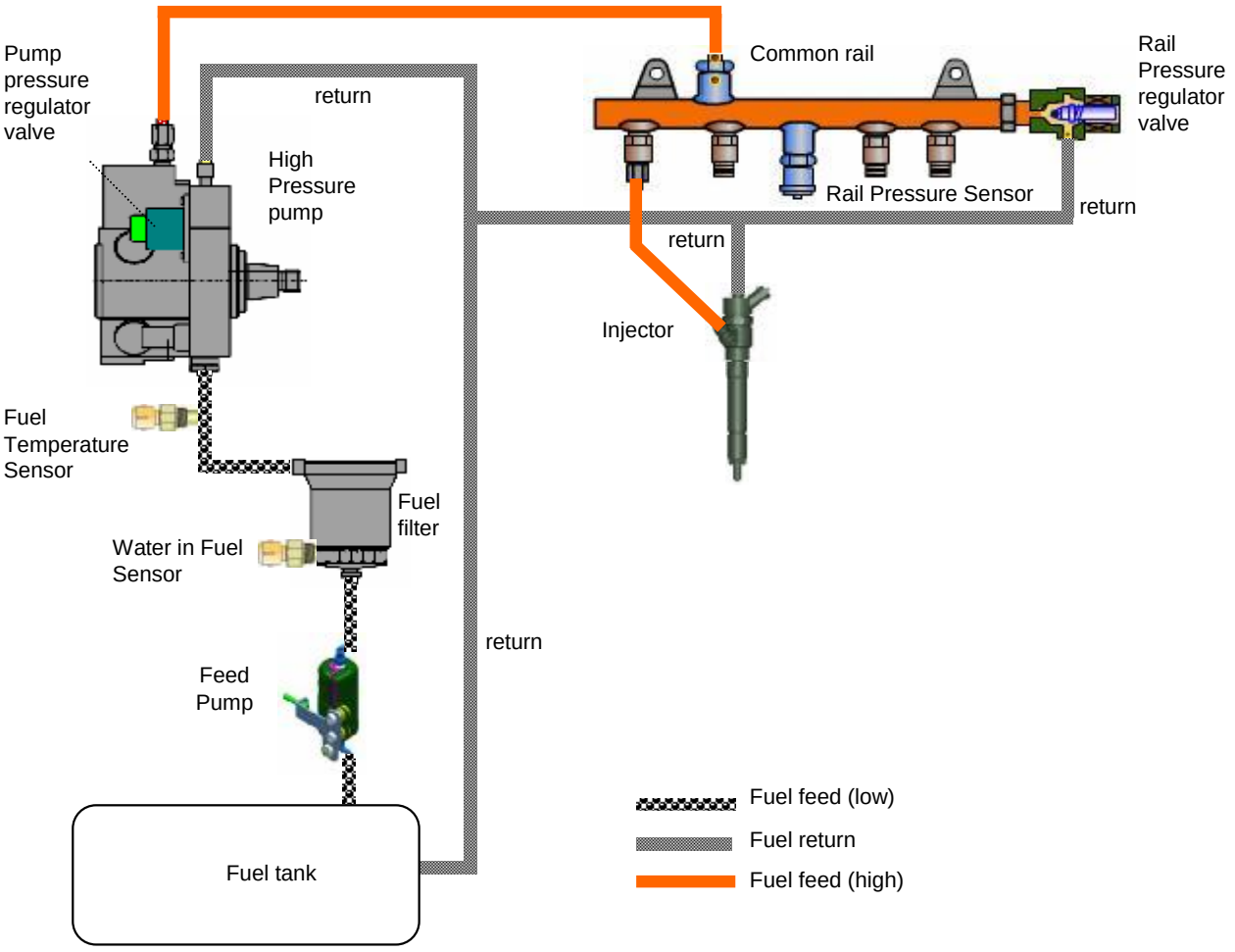


CAUTION

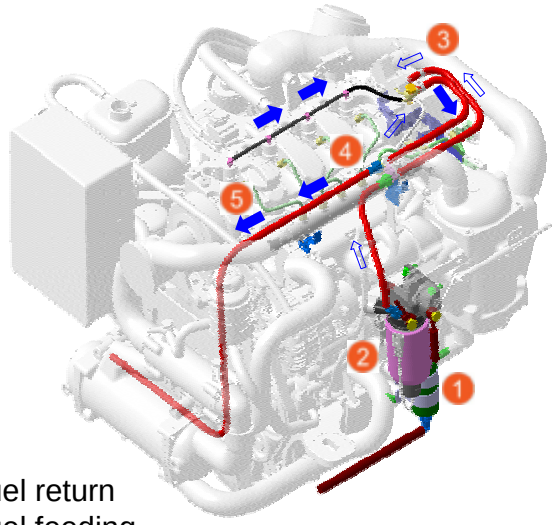
IF IN DOUBT ABOUT EXHAUST SYSTEM INSTALLATION, PLEASE CONTACT YOUR NEAREST HYUNDAI SeasAll DEALER.

CHAPTER 4
FUEL SYSTEM

The fuel supply system of this engine is diesel common rail direction injection. In order to optimize engine combustion, its maximum injection pressure is up to 1600 bar. Multi-injection is possible thanks to the quick response of the solenoid type injector.



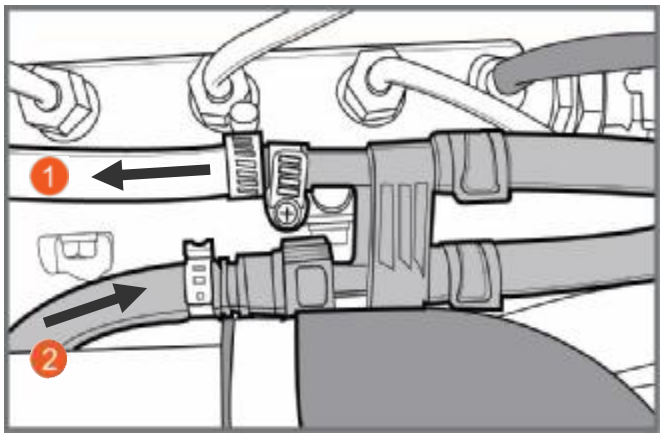
1. THE FLOW OF FUEL

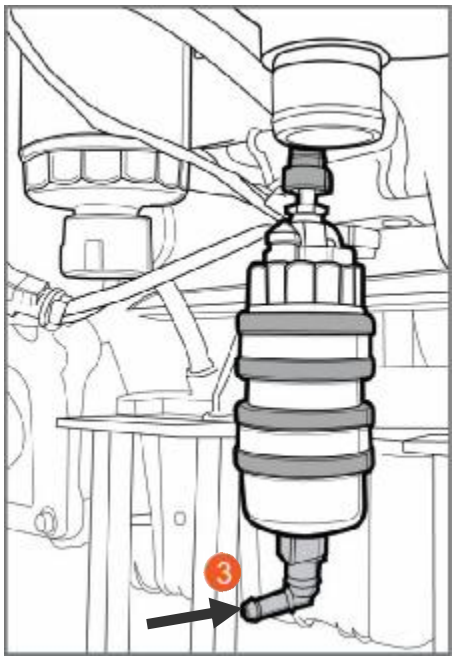


➡ Fuel return
⇨ Fuel feeding

Fuel tank
↓
Auxiliary fuel filter
↓
① Fuel pump (low pressure)
↓
② Fuel filter with water detection sensor
↓
③ High pressure pump
↓
④ Common rail
↓
⑤ Injector or return to fuel tank

2. LOW PRESSURE FUEL LINE

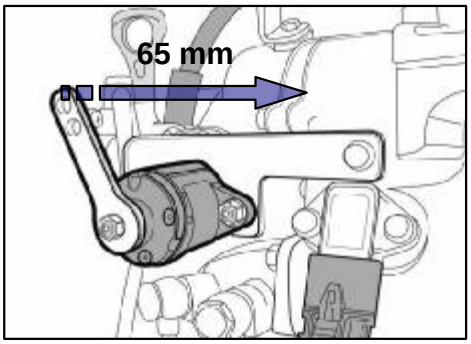




① Return line to fuel tank (engine out)
② Feeding line from main fuel filter to high pressure pump
③ Feeding line from fuel tank to electric feed pump (low pressure pump)
※ The internal diameter of all fuel lines must be at least 8 mm.

3. ACCELERATION SENSOR AND CONTROL LEVER

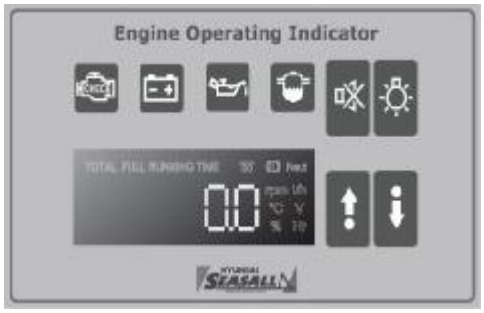
When installing control lever cable to acceleration sensor, be sure that the acceleration sensor lever is fully released to the idle position and fully pulled to the full-load position. The swing distance of lever between idle and full-load position is 65mm.



The procedures for control lever installation

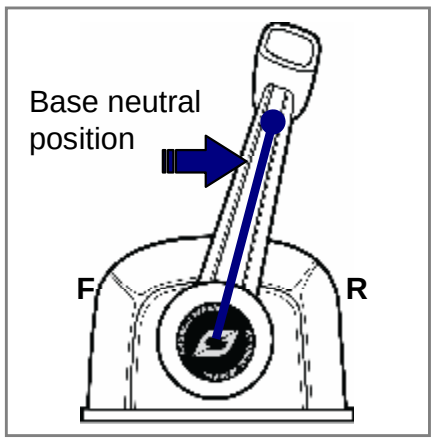
1) Idle position setting

You can make sure that the position value(%) should indicate 0% at neutral condition.



2) Full load position setting

You can make sure that the position value(%) should indicate full load range(90~99.2%) adequately at fully forward lever condition. If not fulfilled, you need to disassemble and adjust the base neutral position of control lever by moving it to the rear until fulfilled.



CAUTION

YOU SHOULD PERFORM ABOVE PROCEDURES ON CONDITION ENGINE IS NOT RUNNING BUT IGNITION KEY ON AFTER CONTROL LEVER INSTALLATATION.

4. RECOMMENDED FUEL QUALITY

The following fuels should be used for engine operation:

- Standard summer / winter diesel fuel according to DIN EN 590 (classes A-F)
- Diesel fuel according to DIN EN 590 (classes 0-4) in arctic climates
- Summer diesel fuel according to California and U.S. federal regulations
- Winter diesel fuel if lubricity is comparable to diesel fuel according to DIN EN 590
- Mixture of diesel fuel with 5 Vol.% RME according to DIN 51606
- Later admixing or additional use of additives, gasoline or special fuels is not permitted

5. DRAINING WATER FROM FUEL FILTER

1) The fuel filter for a diesel engine plays an important role of separating water from fuel and accumulating the water in its base. If water accumulates in the fuel filter, a warning light comes on when the ignition switch is at the ON position.

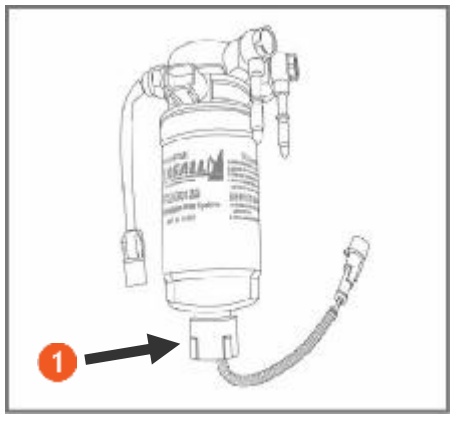
2) If the water in the fuel filter is over the limit, the Water Sensor Lamp on the EOI will light up. If this happens, you must stop the engine and drain the water in fuel filter yourself or ask the nearest workshop to do this.

3) Water and a little fuel will drain at the same time. Therefore, avoid flames in your workspace.

4) If your fuel is not well suited to your engine, more frequent drainage will be required.

5) To check and drain the water in fuel filter:

   - Loosen the drain plug (part ①) and drain water. 100 ~ 120cc drainage is proper
   - After water is drained, securely tighten the drain plug
   - After starting the engine, check to make certain the fuel filter warning light is off



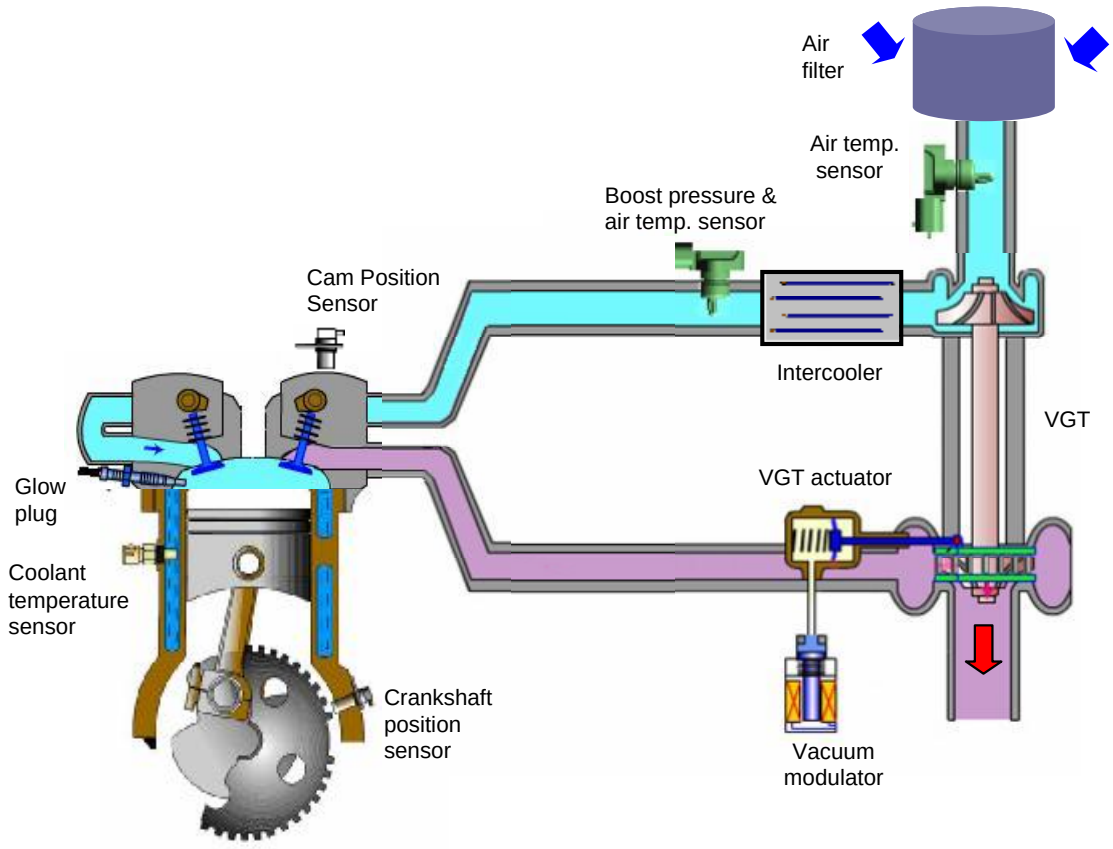
CAUTION

HYUNDAI SeasAll'S GUARANTEES OR WARRANTIES ARE VOID IN CASES WHERE DAMAGE TO THE FUEL INJECTON COMPONENTS (HIGH PRESSURE PUMP, INJECTORS, ETC.) CAN BE ATTRIBUTED TO THE USE OF UNQUALIFIED FUELS.

IF THE WATER ACCUMULATED IN THE FUEL FILTER IS NOT DRAINED AT PROPER TIMES, DAMAGE TO MAJOR ENGINE PARTS. WHEN REPLACING THE FUEL FILTER CARTRIDGE, USE GENUINE PARTS ONLY.

CHAPTER 5
AIR INTAKE SYSTEM

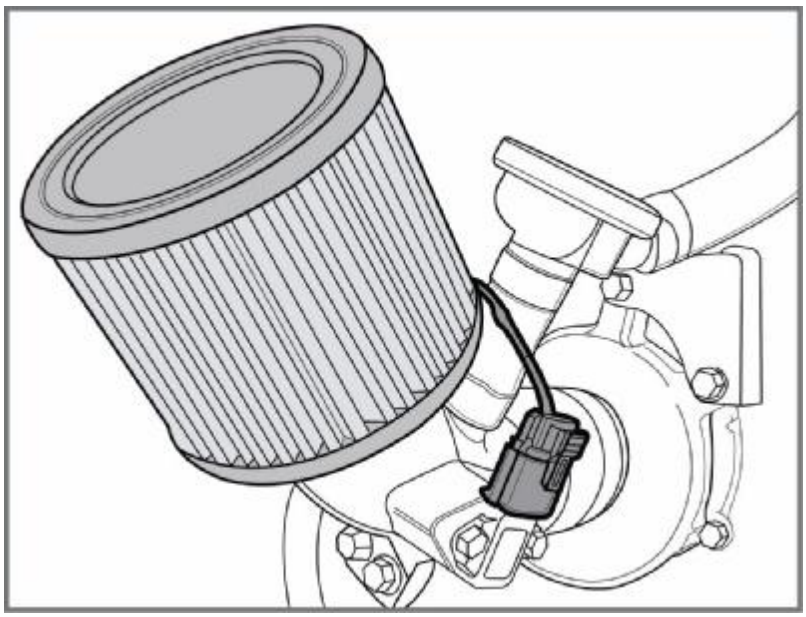
The intake air system of this engine is optimized by VGT and a highly efficient intercooler system. The pressure of the air system is up to about abs. 2.5 bar in order to optimize engine combustion.



1. ENGINE ROOM VENTILATION

1) Engines with turbo-charger air inlet systems require much more air pumped and cooled. (Maximum air consumption is 600kg/h, minimum engine room vent area is 40cm^2.)
2) The fresh and cooled air must be pumped into the engine in order to perform at normal power and fuel consumption.
3) The temperature at the air inlet should be as low as possible. A high temperature of inlet air may reduce engine performance.

2. AIR FILTER MAINTENANCE



1) The air filter must be cleaned regularly. If the engine is operated in a dirty environment, clean the filter more frequently.
2) Blow out the air filter from the inside toward the outside with max. 2.0 bar compressed air.
3) Never use petrol, thinner or other agents for cleaning. Such products can destroy the filter.

CAUTION

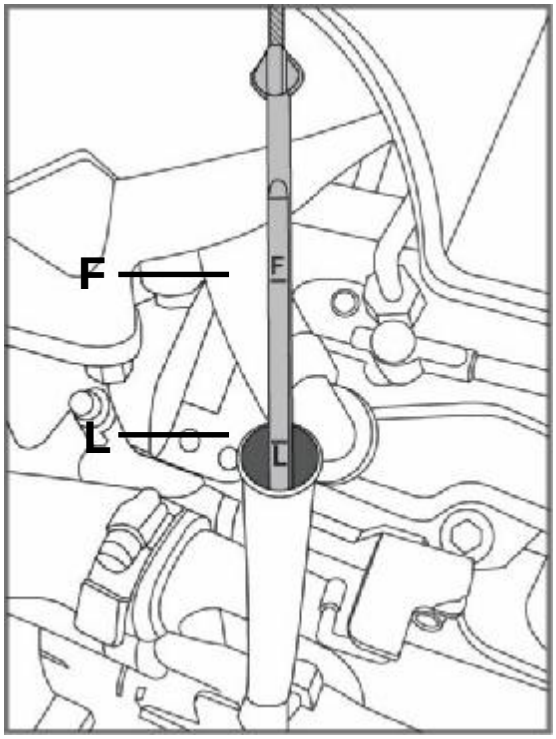
WHEN REMOVING THE AIR FILTER, BE CAREFUL THAT DUST OR DIRT DOES NOT ENTER THE AIR INTAKE, OR DAMAGE MAY RESULT. AND DO NOT RUN WITHOUT AIR CLEANER. THIS COULD RESULT IN EXCESSIVE ENGINE WEAR.
USE OF NON-GENUINE PARTS COULD DAMAGE THE TURBO CHARGER OR ENGINE.

CHAPTER 6
LUBRICATION SYSTEM

1. ENGINE OIL LEVEL CHECKS

The engine oil level must be checked at regular intervals.

- Be sure the boat is level.
- Start the engine and allow it to reach normal operating temperature.
- Turn the engine off and wait about 5 minutes, until the oil has returned to the oil pan.
- Pull the dipstick out, wipe it clean, and re-insert it fully.
- Pull the dipstick out again and check the level. The level should be between F and L. If it is near or at L, add enough oil to bring the level to F. Do not fill with engine oil above the F mark.



2. RECOMMENDED OIL QUALITY

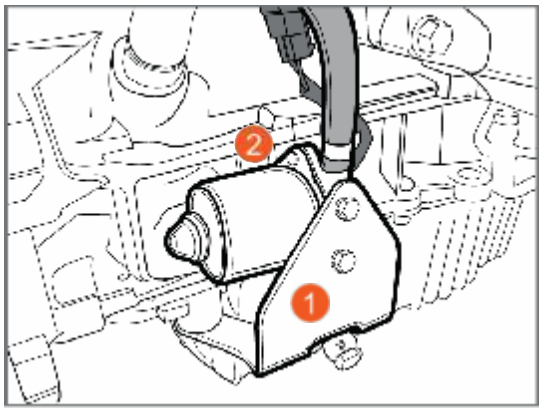
For best performance and maximum protection during all types of operation, select only those lubricants which :

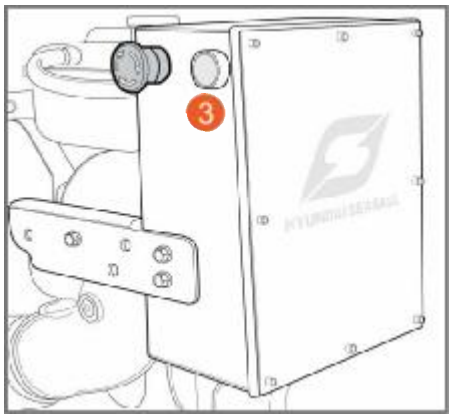
1) Satisfy the requirement of the API or ACEA classification.

2) Have proper SAE grade number for expected ambient temperature range.

Description		Specifications	Limit
Oil quality	ACEA	Above B4	Service oil quality should conform to ACEA or API classification.
	API	Above CH - 4	
	SAE	15W-40	-15˚C above
		10W-30	-20˚C ~ 40˚C
		5W-30	-25˚C ~ 40˚C
		0W-30	10˚C below

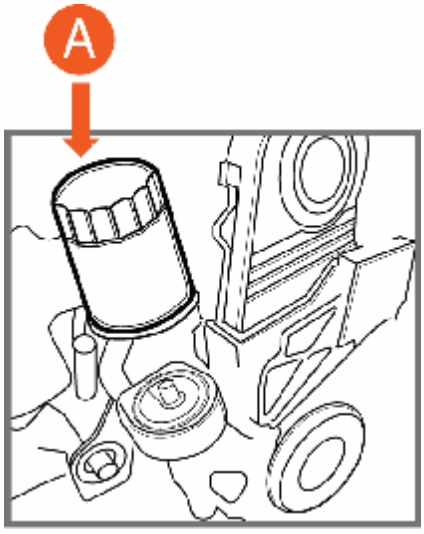
3. ENGINE OIL EXTACTION PUMP





1) Allow the engine to warm up at least 5 minutes.
2) Remove the engine oil inlet cap and oil filter.
3) The supplied oil change hose is connected on to the oil extraction pump ①, and you must route the other end of the hose into the container being used for the oil change②.
4) Turn the ignition key on and press and hold button ③ on the left side of the ECU box with the ignition switched on until the engine oil (about 6liters) is completely pumped out.

4. OIL FILTER REPLACEMENT



1) Remove the oil filter (A) with the oil filter wrench.
2) Inspect the threads and O-ring to apply a light coat engine oil onto the new filter. Wipe off the seat.
3) Install the new oil filter by hand.
4) After the packing seats, tighten the oil filter clockwise with the oil filter wrench. (2.3 ~ 2.5kgf·m / 24.5 Nm)
5) Complete the reassembly and start the ignition. Then check any oil leakage.

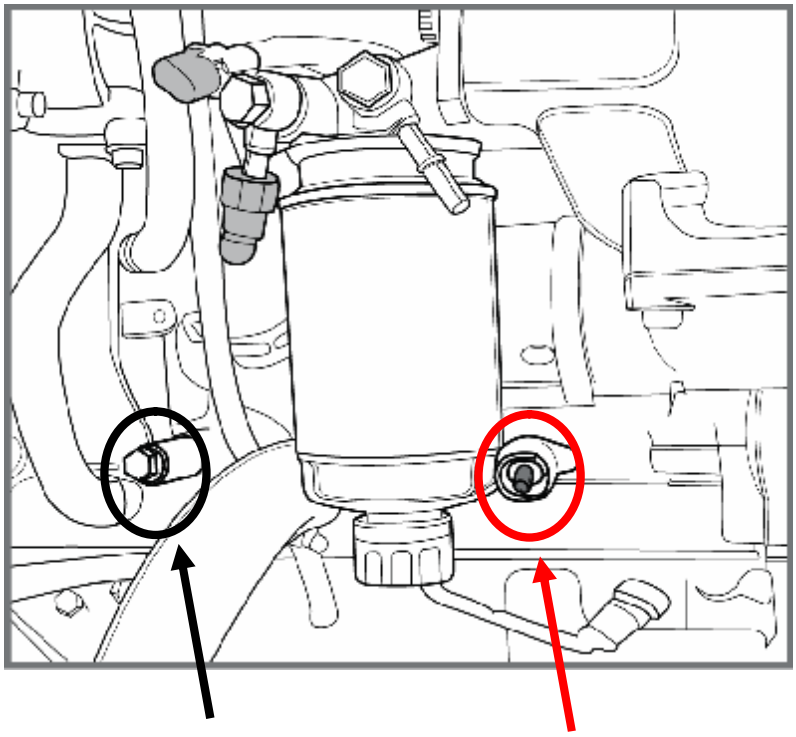
WARNING

USED OIL MUST BE STORED IN A SAFE PLACE AWAY FROM CHILDREN AND FIRE PLACE UNTIL ITS PROPER DISPOSAL. IF YOU HAVE DISPOSAL PROBLEM, PLEASE CARRIED OUT ENGINE OIL CHANGE BY A NEAREST HYUNDAI SEASALL SERVICE NETWORKS.

CHAPTER 7
ELECTRICAL SYSTEM

1. BATTERY CABLE CONNECTIONS

1) The diameter of battery cable should be at least 40mm^2 within a length of 4m.
2) And it should be at least 50mm^2 if the cable is longer than 4m.
3) Recommended battery capacity is over 150 amperes.
4) Connect the battery (+) cable from the battery to the start motor with the cable from alternator (+) cable.
5) Connect the battery (-) cable from the battery to engine block.
6) Battery cables should be clean and tightly connected.



(ENGINE GROUND, -) **(START MOTOR , +)**

WARNING

DO NOT TOUCH OR REMOVE ELECTRICAL PART WHEN STARTING OR DURING OPERATION.
KEEP HAND, HAIR, AND CLOTHES AWAY FROM THE FLYWHEEL AND OTHER ROTATING PARTS WHILE THE ENGINE IS RUNNING.

2. BATTERY CHECKS

Battery inspection is very important in electronic control engines: You must check the battery condition regularly.

LOAD TEST

1) Perform the following steps to complete the load test procedure for maintenance-free batteries.
2) Connect the load tester clamps to the terminals and proceed with the test as follows:
   a. If the battery has been charged, remove the surface charge by connecting a 300 ampere load for 15 seconds.
   b. Connect the voltmeter and apply the specified load.
   c. Read the voltage after the load has been applied for 15 seconds.
   d. Disconnect the load.
   e. Compare the voltage reading with the minimum and replace the battery if the voltage is less than shown in the table, replace the battery. If the voltage is greater than shown in the table, the battery is good.

Voltage	Temperature
9.6	20°C (70°F) and above
9.5	16°C (60°F)
9.4	10°C (50°F)
9.3	4°C (40°F)
9.1	-1°C (30°F)
8.9	-7°C (20°F)
8.7	-12°C (10°F)
8.5	-18°C (0°F)

WARNING

BATTERY MUST BE STORED AND TREATED IN A SAFE PLACE AWAY FROM CHILDREN AND FIRE PLACE.
FLUID IN THE BATTERY IS A CORROSIVE ACID AND MUST BE HANDLED WITH CARE. IF SPILLED ON ANY PART OF BODY, FLUSH IMMEDIATELY WITH WATER.

CAUTION

DO NOT LOOSEN OR DETACH BATTERY TERMINALS WHILE ENGINE IS RUNNING. DOING SO WILL DAMAGE CHARGING SYSTEM AMD OTHER ELECTRONIC DEVICES.

3. FUSE AND RELAY

3. 1 FUSE

An engine's electrical system is protected from electrical overload damage by fuses.

If a fuse has blown, the element inside the fuse will be melted. If the electrical system does not work, first check the fuses in ECU box. Always replace a blown fuse with one of the same rating.

If the replacement fuse blows, this indicates an electrical problem. Avoid using the system involved and immediately consult an authorized Hyundai SeasAll dealer.

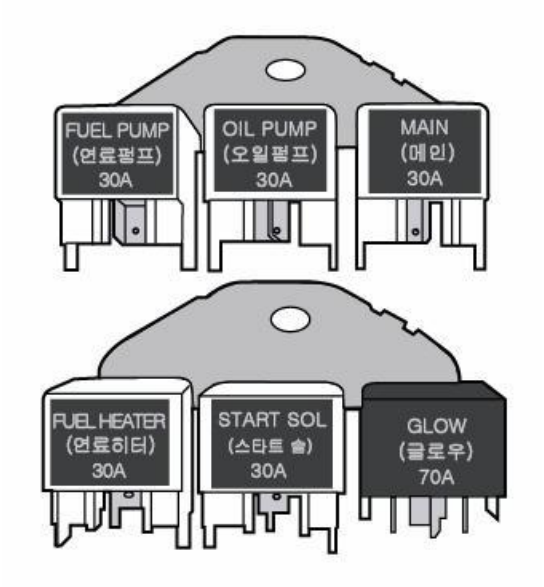
Fuses in the ECU Box

1) System Power_30Amp
2) Ignition Power_5Amp
3) ECM(ECU) Power_20Amp
4) Main Relay Power_15Amp
5) Spare_30Amp
6) Fuel Filter_30Amp

3.2 RELAY

Relay in the ECU Box

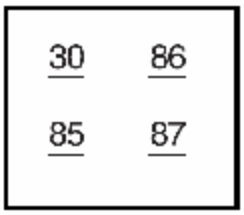
1) Main Relay_30Amp
2) Oil Extract Relay_30Amp
3) Fuel Pump Relay Power_30Amp
4) Spare_30Amp
5) Start Sol. Relay_30Amp
6) Fuel Heater Relay _30Amp

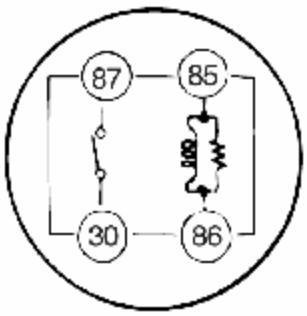


Using an ohmmeter, check that there is continuity between each terminal.

Terminal	Continuity
30 - 87	NO
85 - 86	YES

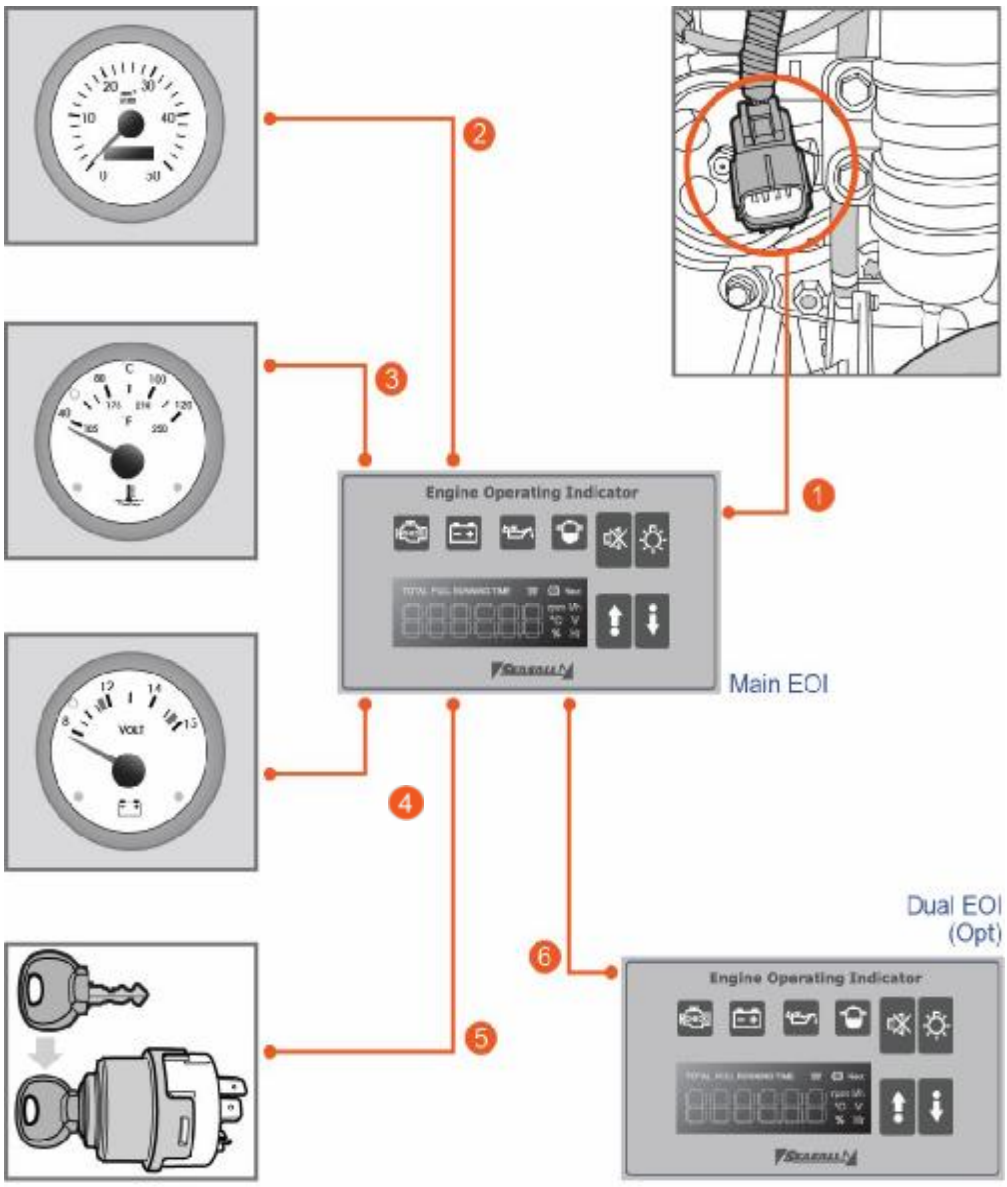
Apply 12V to terminal 85 and ground to terminal 86. Check for continuity between terminals 30 and 87. Always replace a damaged relay with one of the same rating.





CHAPTER 8
INSTRUMENT SYSTEM

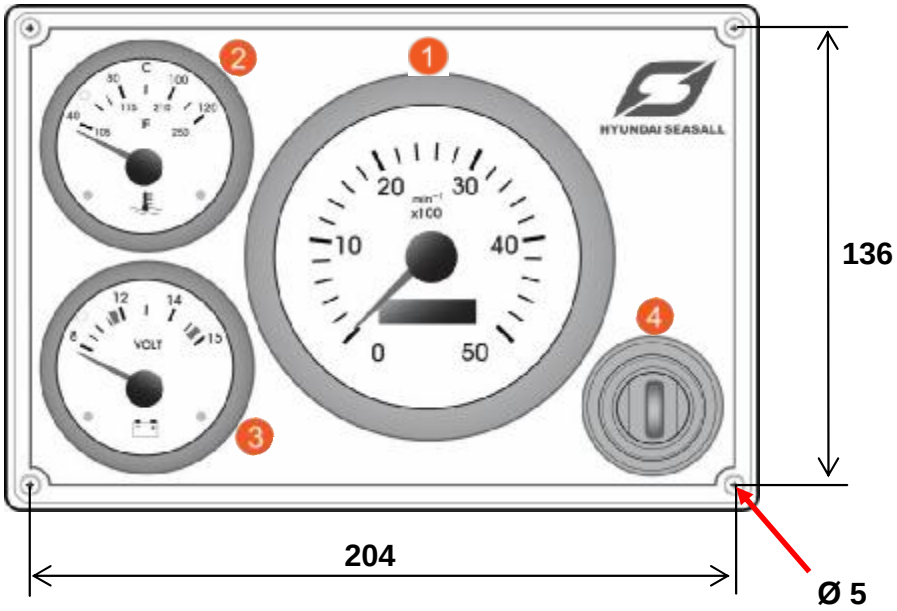
1. INSTRUMENTS CONNECTION



1. Engine to EOI wiring (standard: 7m, option: 10m)
2. EOI to RPM gauge(Ø 85) wiring
3. EOI to coolant temp gauge(Ø 52) wiring
4. EOI to volt gauge(Ø 52) wiring
5. EOI to ignition key switch(Ø 21.4) wiring
6. Dual EOI wiring (option for dual stage)

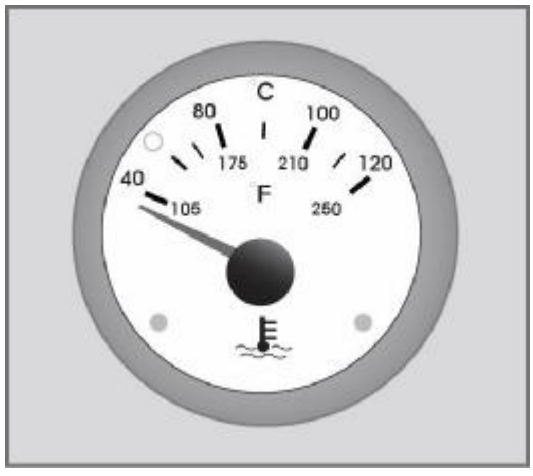
※ For information about the installation and operation of the EOI (Engine Operating Indicator) system, please refer to Chapter 9.

1.1 Standard instrumentation



1. RPM Gauge
2. Coolant Temperature Gauge
3. Battery Volt Meter Gauge
4. Ignition Key switch

1.2 COOLANT TEMPERATURE GAUGE



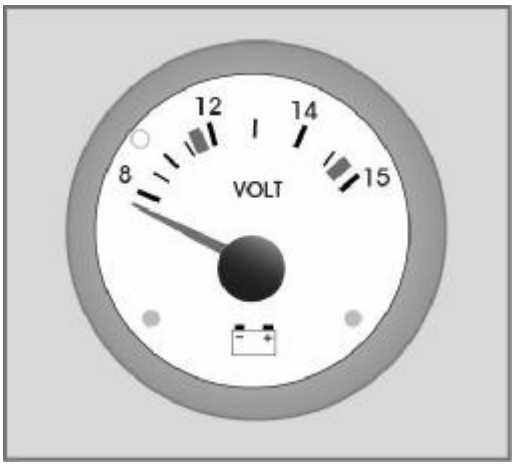
1) When the key is at ignition ON position, this gauge will work.
2) Avoid max. rpm and WOT (Wide Open Throttle) before a cold engine is fully warmed up, as it can harm the engine.
3) The gauge needle should be in proper range. If the outside temperature is high, the gauge needle may sit at a higher range. As long as the alarm doesn't sound, the engine is normal.
4) If the gauge blinks and an EOI alarm sounds EOI, check the coolant temperature and level. If the coolant is low, refill it.
5) If the temperature of the engine coolant is higher than 105℃, the engine power will decrease. You should check the engine cooling system.

1.3 RPM GAUGE

1) When the key is at ignition ON position, this gauge will work.
2) This gauge indicates real-time engine rpm.
3) Avoid max. rpm and WOT (Wide Open Throttle) before a cold engine is fully warmed up, as it can harm the engine.

1.4 BATTERY VOLT METER GAUGE

1) When the key is at ignition ON position, this gauge will work.
2) This gauge indicates real-time battery bolt.
3) If battery bolt is not sufficient, the engine can not be started.
4) For a working engine, 12～16V bolt is normal. If the battery bolt is under 12V, you should check battery and alternator.
5) At the moment of engine ignition, the bolt meter needle may move down to 8V temporarily. This is normal.



2. CUT-OUT FOR GAUGE

- RPM Gauge : Ø 86 mm
- Coolant Temperature Gauge : Ø 53 mm
- Battery Volt Meter Gauge : Ø 53 mm
- Ignition Key : Ø 27 mm

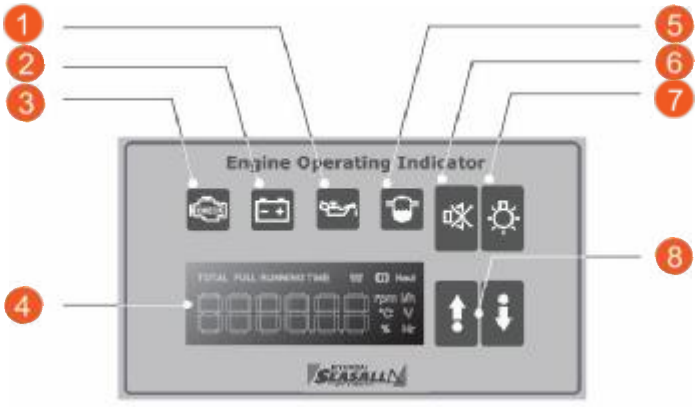
3. CUT-OUT FOR EOI SYSTEM

You can use an installation template enclosed with EOI for a cut-out.

CHAPTER 9
EOI SYSTEM

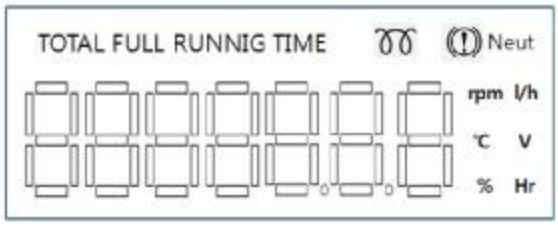
The Engine Operating Indicator (EOI) system gives you a lot of information about the engine's current workings. You can hear alarm beeps, or see information including RPM, coolant temperatures, warning lamps, error codes and engine working time. If the switch is on, warning lamps for battery, engine oil and so on are flashed on. Then if the engine starts normally, the lamps all go off. If there is a problem, the specific lamp will come on. You should contact a close dealer and have engine checked as soon as possible in this case

1. OVERVIEW OF EOI SYSTEM



① Engine Oil pressure Warning Lamp
② Alternator Charging Warning Lamp
③ Engine Check Lamp
④ Information LCD
⑤ Water detection Warning Lamp
⑥ Buzzer Reset Switch
⑦ Dimmer Switch
⑧ Function Switch

1.1 INFORMATION LCD ITEM



1) Engine rpm (RPM)
2) Engine Coolant Temp. (℃)
3) Lever Position (%)
4) Fuel Consumption (ℓ /h)
5) Battery Bolt (V)
6) Running Time (Hr)
7) Total WOT running Time (Hr)
8) Glow Indicator lamp
9) Neutral Lever Alarm lamp Neut
10) DTC (Diagnosis Trouble Code)

1.2 SWITCHES

1) Buzzer Reset Switch - This switch is used for turning off the alarm temporarily.
2) Dimmer Switch - This switch is used for controlling brightness of the other gauges connected to the EOI.
3) Function Switch - This switch is used for changing the information display on the LCD.

1.3 ALARM LAMPS

Alarm may sound when alarm lamps flicker.

WATER SENSOR LAMP

- This lamp informs you to extract water from fuel filter.
- If the lamp is on, you should stop the engine immediately and extract the water in the fuel filter.
- It is recommended to check and extract the water in the fuel filter at fixed periods before the lamp turns on.
- It can be harmful to drive your engine with this lamp on.

ALTERNATOR LAMP

- This lamp informs you to recharge your battery.
- If this lamp turns on, you should stop the engine and eliminate electric load, as well as check the alternator, drive belt system and wiring system.

ENGINE OIL LAMP

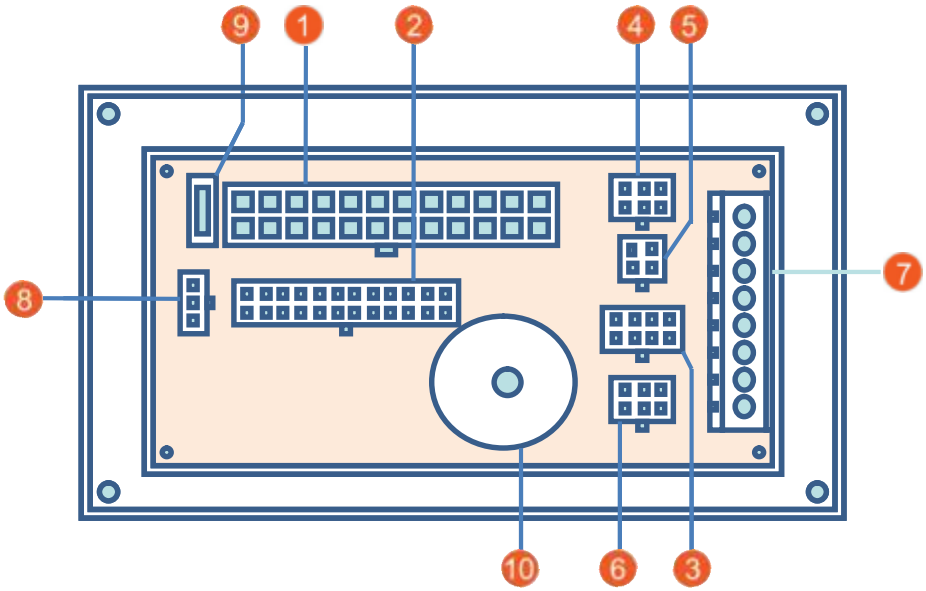
- This lamp informs you that the engine oil pressure.

  If this lamp is on, you should stop the engine and check the oil level with oil gauge. If the oil is low, refill it. If you refill the oil and the lamp still does not turn off, you should ask your local service shop for maintenance.

CHECK ENGINE LAMP

- This lamp informs you that the engine has a serious problem.
- You can see the DTC on the LCD of the EOI .
- It is possible to drive at limited rpm. The ECU will control the functions to protect the engine. You should check the engine at the nearest service shop immediately.

2. EOI CONNECTIONS



Rear view

1. Connection plug – CN1 (from engine)
2. Connection plug – CN2 (to dual EOI)
3. Connection plug – CN3 (tachometer)
4. Connection plug – CN4 (coolant tem. gauge)
5. Connection plug – CN5 (volt gauge)
6. Connection plug – CN6 (service tool)
7. Connection plug – CN7 (external)
8. Connection plug – CN8 (key box)
9. System power fuse (3 amp)
10. Buzzer

WARNING

LISTEN FOR A CLICK WHEN LOCKING CONNECTORS. THIS SOUND INDICATES THAT THEY ARE SECURETY LOCKED.

CAUTION

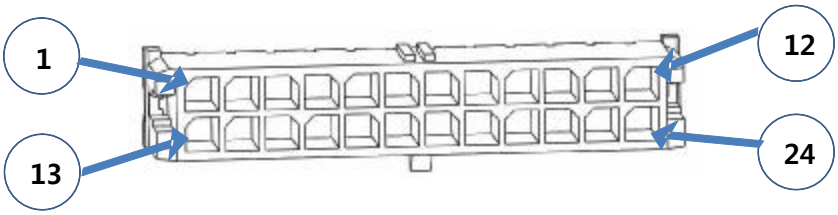
DON'T CONNECT EXTRA INSTRUMENTS WHICH CAPACITY IS OVER 1 AMPERE, THE E.O.I WOULD BE DAMAGED BY OVERLOAD.

3. EOI PIN ASSIGNMENT

CN1 (MAIN EOI CONNECTOR FROM ENGINE)

1. Ignition power
2. Main relay power
3. Permanent power
4. Not used
5. Not used
6. Coolant temperature signal
7. Not used
8. Check lamp
9. Oil pressure signal
10. Gnd
11. Not used
12. Water detection signal
13. RPM signal
14. Spare
15. Spare
16. Spare
17. Neutral signal
18. K line
19. CAN_L
20. Changing signal
21. CAN_H
22. Not used
23. Gnd
24. Not used

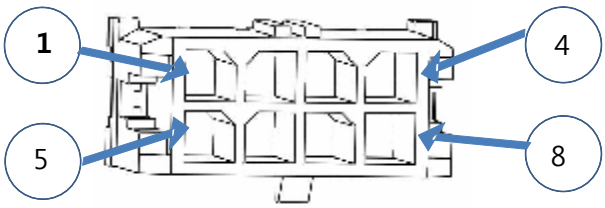
CN2 (DUAL EOI CONNECTOR)



1. Ignition power
2. Main relay power
3. Permanent power
4. Not used
5. Not used
6. Not used
7. Not used
8. Check lamp
9. Oil pressure signal
10. Gnd
11. Not used
12. Water detection signal
13. RPM signal
14. Spare
15. Spare
16. Spare
17. Neutral signal
18. K line
19. CAN_L
20. Changing signal
21. CAN_H
22. Not used
23. Gnd
24. Not used

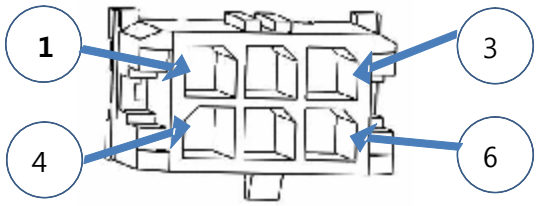
CN3 (TACHOMETER)

1. Main relay power
2. RPM signal
3. Gnd
4. illumination
5. illumination
6. CAN_H
7. CAN_L
8. Not used



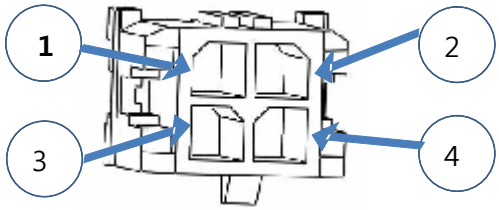
CN4 (COOLANT TEMP. GAUGE)

1. Coolant temperature signal
2. Ignition power
3. Gnd
4. illumination
5. illumination
6. Not used



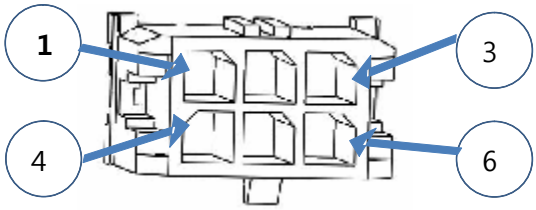
CN5 (VOLT GAUGE)

1. Ignition power
2. Gnd
3. illumination
4. illumination



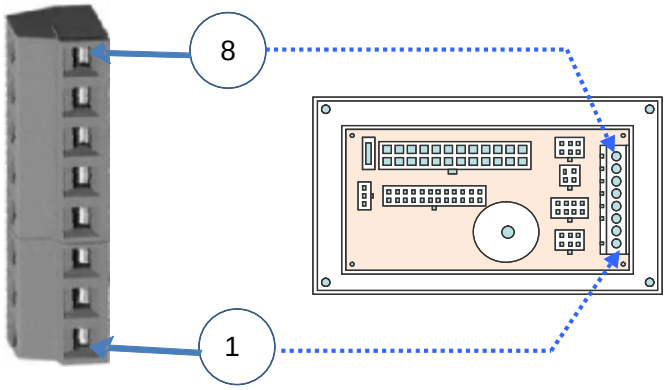
CN6 (SERVICE TOOL)

1. CAN_H
2. CAN_L
3. K_line
4. Gnd
5. Main relay power
6. Not used



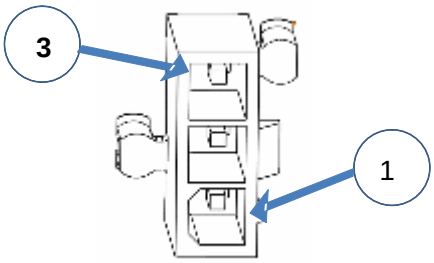
CN7 (EXTERNAL)

1. Gnd
2. Permanent power
3. Ignition power
4. Neutral switch
5. Neutral switch
6. Charging signal
7. RPM signal
8. Dimmer



CN8 (KEY BOX)

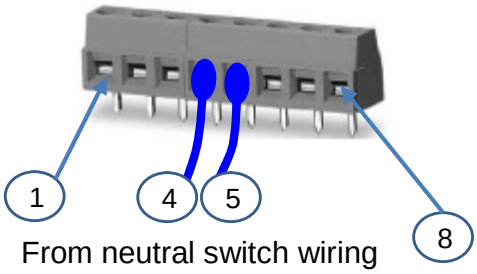
1. Ignition power
2. Start power
3. Permanent power



4. NEUTRAL SWITCH AND DUAL EOI CONNECTION

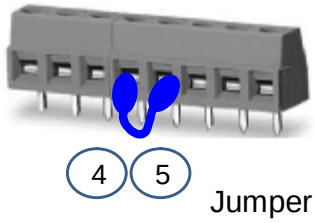
1) Neutral switch wires should be connected at pin #4 and #5 of the external connector of the EOI. If there is no neutral switch, jumper #4 and #5 with short wiring.

SYSTEM WITH A NEUTRAL SWITCH



From neutral switch wiring

SYSTEM WITH NO NEUTRAL SWITCH

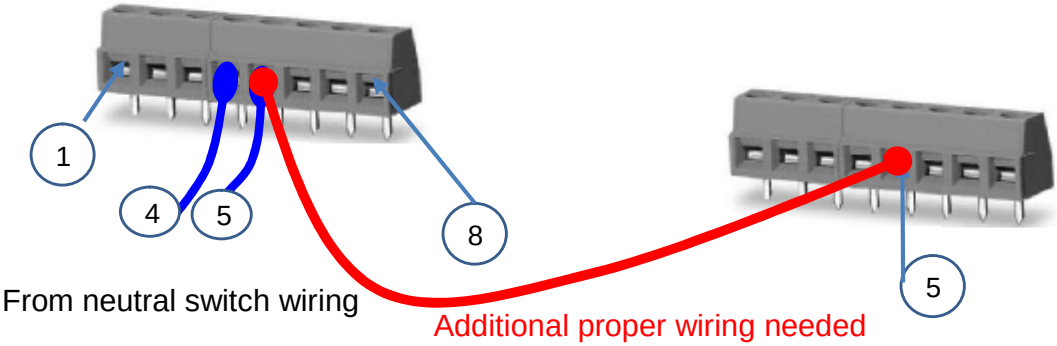


Jumper

2) If there is a dual EOI, you should connect the wiring between #5 (external connector of the main EOI) and #5 (external connector of the dual EOI)

Main EOI external connector

Dual EOI external connector



From neutral switch wiring

Additional proper wiring needed

CAUTION

ENGINE WOULD NOT CRANK AND START FOR USER'S SAFETY IF GEAR POSITION IS NOT NEUTRAL OR NOT CONNECTED TO EOI EXTERNAL CONNECTION.

5. ALARM AND DTC(DIAGNOSIS TROUBLE CODE)

If there is a problem with the engine, the EOI display (audible or visible) alarm and related DTC (diagnosis trouble code) will give you information about it. The DTC display is only for initial assistance and to aid communication with a Hyundai SeasAll dealer if there is an emergency. You should contact your nearest Hyundai SeasAll dealer as soon as possible if a system problem arises.

5.1 ALARM LIST

Item	DTC	Description	Fail safety		Alarm		Expectation Cause(s)
			Fuel cut off	Note 1) RPM limit	Lamp	Buzzer	
VGT variable geometry turbocharger	P2263	EVGT controller overheat, learning error, feedback line error	-	○	CHECK	√	• Overload, VGT cooling circuit • VGT actuator adaption error • VGT actuator performance error
	P2563	PWM failure					
	P0048	Short circuit battery	-		CHECK	√	• VGT actuator circuit • VGT actuator
	P0047	Short circuit ground					
		No Load					
	P0234	Boost pressure higher than target value	-		CHECK	√	• VGT actuator performance error
	P0299	Boost pressure lower than target value					• Air leakage check • Intercooler • VGT actuator performance error
APS1 acceleration position sensor1	P2138	Plausibility With Aps2 Violated	-	1250 rpm fixed	CHECK	√	• APS1/2 sensor circuit • APS sensor • ECM (engine control module)
	P2127	Voltage Above Lower Limit					
	P2123	Voltage Above Upper Limit					
	P0643	Supply Voltage Above Upper Limit					
	P0642	Supply Voltage Below Lower Limit					
APS2 acceleration position sensor2	P2128	Voltage above upper limit					
	P0653	Supply voltage above upper limit					
	P0652	Supply voltage below lower limit					
CMPS cam position sensor	P0340	No camshaft signal	√ (at starting)	●	CHECK	√	• CMPS circuit • CMPS
	P0341	Wrong camshaft signal					
CKPS crank position sensor	P0335	No crankshaft signal (engine running)	√	-	CHECK	√	• CKPS circuit • CKPS • Target wheel check
	P0336	Wrong crankshaft signal (restart)					
Water detection in fuel	P2264	Water in fuel is detected	-	●		√	• Water in fuel, fuel filter (drain out water and check the fuel in fuel tank) • Warning lamp circuit • Water detection sensor error
Cylinder1 injector	P0201	Open load		○	CHECK	√	• Injector circuit • Injector
	P0261	Short circuit ground	√	-			
	P0262	Short circuit battery					
	P0263	Defect resistance cylinder1, Charging/discharging energy error	-				
Cylinder2 injector	P0202	Open load		○	CHECK	√	• Injector circuit • Injector
	P0264	Short circuit ground	√	-			
	P0265	Short circuit battery					
	P0266	Defect resistance cylinder1, Charging/discharging energy error	-				

Item	DTC	Description	Fail safety		Alarm		Expectation Cause(s)
			Fuel cut off	Note 1) RPM limit	Lamp	Buzzer	
Cylinder3 injector	P0203	Open load		○			• Injector circuit • Injector
	P0267	Short circuit ground	√	-			
	P0268	Short circuit battery					
	P0269	Defect resistance cylinder1, Charging/discharging energy error	-				
Cylinder4 injector	P0204	Open load		○			• Injector circuit • Injector
	P0270	Short circuit ground	√	-			
	P0271	Short circuit battery					
	P0272	Defect resistance cylinder1, Charging/discharging energy error	-				
Note 2) Cylinder5 injector	P0205	Open load		○			• Injector circuit • Injector
	P0273	Short circuit ground	√	-			
	P0274	Short circuit battery					
	P0275	Defect resistance cylinder1, Charging/discharging energy error	-				
Note 3) Cylinder6 injector	P0206	Open load		○			• Injector circuit • Injector
	P0276	Short circuit ground	√	-			
	P0277	Short circuit battery					
	P0278	Defect resistance cylinder1, Charging/discharging energy error	-				
Injector Bank Error	P062D	Bank 1 error	√	-			• Charging system (battery, alternator check) • ECM
	P062E	Bank 2 error					
Injectors Circuit	P0611	Error path for short circuit of charging switch is detected	√	-			• Injectors circuit • ECM
	P0200	Injector circuit error					
RPS rail pressure sensor	P0193	Voltage above upper limit	-	●			• PRS circuit • PRS • APS 2 power supply circuit • BPS power supply circuit • ECM
	P0192	Voltage below lower limit					
	P0653	Supply voltage above upper limit					
	P0652	Supply voltage below lower limit					
Rail pressure Monitoring	P0087	Maximum positive deviation of rail pressure exceeded	-	○			• Fuel filter • RPS check • P-PRV , PRV check(stuck)
	P0088	Maximum negative deviation of rail pressure exceeded					
	P1171	Minimum rail pressure exceeded	√	-			
	P1172	Maximum rail pressure exceeded	-	○			
BPS boost pressure sensor	P0238	Voltage above upper limit	-	●			• BPS circuit • BPS • RPS power supply circuit • APS 2 power supply circuit • ECM
	P0237	Voltage below lower limit					
	P0069	Not plausible with atmospheric pressure sensor		-	-	-	
	P0653	Supply voltage above upper limit		●			
	P0652	Supply voltage below lower limit					

Item	DTC	Description	Fail safety		Alarm		Expectation Cause(s)
			Fuel cut off	Note 1) RPM limit	Lamp	Buzzer	
PPRV pump pressure regulator vlave	P0254	Short circuit to battery of metering unit output	-	○		√	• P-PRV circuit • P-PRV
	P0253	Short circuit to ground of metering unit output	√	-			
		Open load of metering unit output	-	○			
	P0252	Powerstage error					
PRV (rail) pressure regulator vlave	P0092	Short circuit to battery of pressure control valve output	√	-		√	• PRV circuit • PRV
	P0091	Short circuit to ground of pressure control valve output					
		Open load of pressure control valve output					
	P0089	Powerstage error					
OPS oil pressure sensor	-	Oil pressure low (below 0.8 bar)	-	-		√	• Oil switch, Oil level, Circuit check
Charging Error	-	Charging system error	-	-		√	• Alternator, Charging circuit check
E(C)TS engine coolant temp. sensor	-	Coolant temperature high (above 110℃)	-	Depending temp.	EOI LCD Blinking	√	• ECTS circuit • ECTS • Cooling line check

Note 1) RPM Limit : ● (Rated rpm - 500rpm), ○ (Rated rpm - 800rpm)

Note 2),3) would be applied to S250/220 models

5.2 DTC(DIAGNOSIS TROUBLE CODE) LIST

NO	P code	DESCRIPTION
1	P0016	Crankshaft Position – Camshaft Position Correlation
2	P0047	Turbocharger Boost Control Solenoid Circuit Low
3	P0048	Turbocharger Boost Control Solenoid Circuit High
4	P0069	Manifold Absolute Pressure – Barometric Pressure Correlation
5	P0087	Fuel Rail/System Pressure - Too Low
6	P0088	Fuel Rail/System Pressure - Too High
7	P0089	Fuel Pressure Regulator 1 Performance
8	P0091	Fuel Pressure Regulator 1 Control Circuit Low
9	P0092	Fuel Pressure Regulator 1 Control Circuit High
10	P0097	Intake Air Temperature Sensor 2 Circuit Low
11	P0098	Intake Air Temperature Sensor 2 Circuit High
12	P0107	Atmospheric Pressure Sensor Voltage Lower Limit
13	P0108	Atmospheric Pressure Sensor Voltage Upper Limit
14	P0112	Intake Air Temperature Sensor1 Circuit Low Input
15	P0113	Intake Air Temperature Sensor1 Circuit High Input
16	P0116	Engine Coolant Temperature Circuit Range / Performance
17	P0117	Engine Coolant Temperature Circuit Low Input
18	P0118	Engine Coolant Temperature Circuit High Input
19	P0182	Fuel Temp Sensor A Circuit Low Input
20	P0183	Fuel Temp Sensor A Circuit High Input
21	P0192	Fuel Rail Pressure Sensor Circuit Low input
22	P0193	Fuel Rail Pressure Sensor Circuit High Input
23	P0194	Fuel Rail Pressure Sensor Circuit Intermittent
24	P0201	Cylinder 1 Injector Open Load
25	P0202	Cylinder 2 Injector Open Load
26	P0203	Cylinder 3 Injector Open Load
27	P0204	Cylinder 4 Injector Open Load
28	*P0205	Cylinder 5 Injector Open Load
29	*P0206	Cylinder 6 Injector Open Load
30	P0231	Fuel Pump Secondary Circuit Low

NO	P code	DESCRIPTION
31	P0232	Fuel Pump Secondary Circuit High
32	P0234	Turbocharger Over boost Condition
33	P0237	Turbocharger Boost Sensor "A" Circuit Low
34	P0238	Turbocharger Boost Sensor "A" Circuit High
35	P0252	Pump Pressure Regulation Valve Circuit
36	P0253	Pump Pressure Regulation Valve Circuit Low
37	P0254	Pump Pressure Regulation Valve Circuit High
38	P0261	Cylinder 1 - Injector Circuit Low
39	P0262	Cylinder 1 - Injector Circuit High
40	P0263	Cylinder 1 Contribution/Balance
41	P0264	Cylinder 2 - Injector Circuit Low
42	P0265	Cylinder 2 - Injector Circuit High
43	P0266	Cylinder 2 Contribution/Balance
44	P0267	Cylinder 3 - Injector Circuit Low
45	P0268	Cylinder 3 - Injector Circuit High
46	P0269	Cylinder 3 Contribution/Balance
47	P0270	Cylinder 4 - Injector Circuit Low
48	P0271	Cylinder 4 - Injector Circuit High
49	P0272	Cylinder 4 Contribution/Balance
50	*P0273	Cylinder 5 - Injector Circuit Low
51	*P0274	Cylinder 5 - Injector Circuit High
52	*P0275	Cylinder 5 Contribution/Balance
53	*P0276	Cylinder 6 - Injector Circuit Low
54	*P0277	Cylinder 6 - Injector Circuit High
55	*P0278	Cylinder 6 Contribution/Balance
56	P0299	Turbocharger Under boost
57	P0300	Random/Multiple Cylinder Misfire Detected
58	P0335	Crankshaft Position Sensor A Circuit
59	P0336	Crankshaft Position Sensor A Circuit Range/Performance
60	P0340	Camshaft Position Sensor A Circuit Malfunction

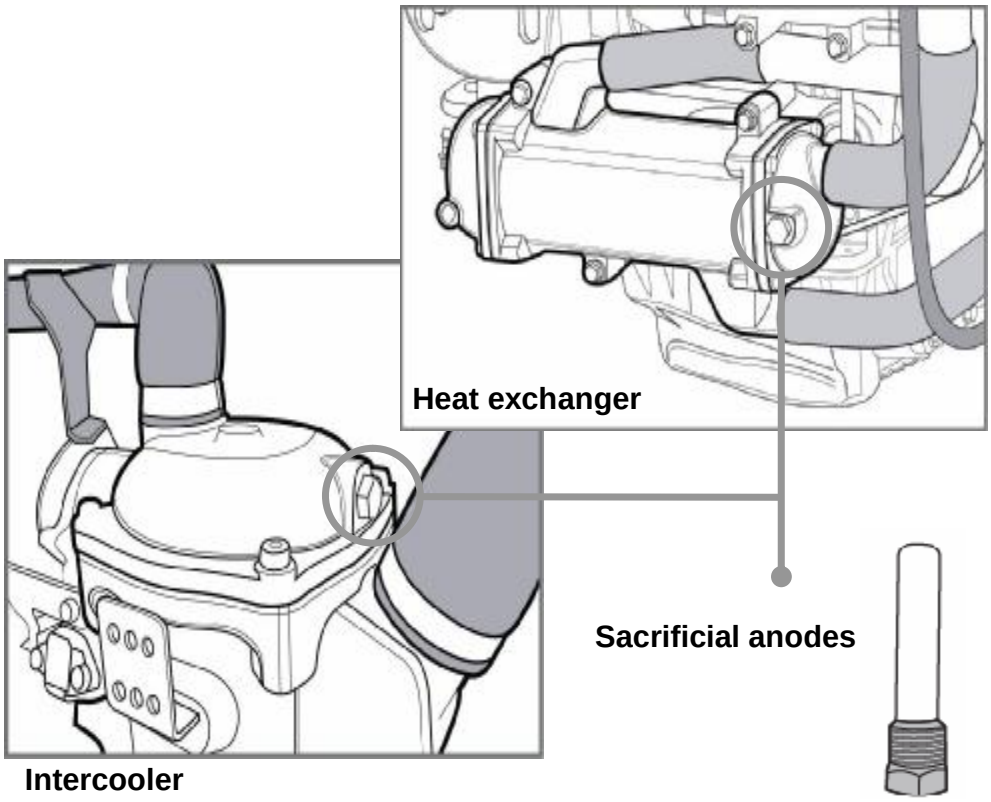
NO	P code	DESCRIPTION
61	P0341	Camshaft Position Sensor A Circuit Range/Performance
62	P0381	Glow Plug/Heater Indicator Circuit
63	P0562	System Voltage Low
64	P0563	System Voltage High
65	P0601	Internal Control Module Memory Check Sum Error
66	P0602	Control Module Programming Error
67	P0604	Internal Control Module Random Access Memory (RAM) Error
68	P0605	Internal Control Module Read Only Memory(ROM) Error
69	P0606	ECM/PCM Processor
70	P0611	Injector Circuit Error
71	P062D	Injector Bank1 Error
72	P062E	Injector Bank2 Error
73	P0642	Sensor Reference Voltage “A” Circuit Low
74	P0643	Sensor Reference Voltage “A” Circuit High
75	P0650	Malfunction Indicator Lamp(MIL) Control Circuit
76	P0652	Sensor Reference Voltage “B” Circuit Low
77	P0653	Sensor Reference Voltage “B” Circuit High
78	*P0670	Glow Plug Module Control Circuit
79	*P0671	Cylinder 1 Glow Plug Circuit
80	*P0672	Cylinder 2 Glow Plug Circuit
81	*P0673	Cylinder 3 Glow Plug Circuit
82	*P0674	Cylinder 4 Glow Plug Circuit
83	*P0675	Cylinder 5 Glow Plug Circuit
84	*P0676	Cylinder 6 Glow Plug Circuit
85	*P0683	Glow Control Module Signal
86	*P0684	Glow Control Module Performance
87	P0685	ECM/PCM Power Relay Control Circuit /Open
88	*P0698	Variable Swirl Actuator Voltage Lower Limit
89	*P0699	Variable Swirl Actuator Voltage Upper Limit
90	P1145	Overrun Monitoring

NO	P code	DESCRIPTION
91	P1171	Minimum Rail Pressure Exceeded
92	P1172	Maximum Rail Pressure Exceeded
93	P1173	Set Value of PCV not in Plausibility Range
94	P1185	Maximum Pressure Exceeded
95	P1186	Minimum Pressure at Engine Speed Too Low
96	P1187	Regulator Valve Stick
97	P1188	Leakage
98	P1307	Acceleration Sensor Range/Performance
99	P1308	Acceleration Sensor Circuit Low Input
100	P1309	Acceleration Sensor Circuit High Input
101	P1325	Glow Relay Malfunction
102	P1636	Voltage Regulator for Injector
103	P1652	Ignition Key No Signal
104	P1653	After-Run Check Error
105	P1655	Tachometer Output Fault
106	P1670	Invalid Injector IQA/C2I
107	P1671	Injector IQA Checksum Error
108	P1679	EMS Data Fail (Data frame, CS, Message error)
109	P1694	EMS Message Error
110	P1695	EMS Memory Error
111	P1697	HI-SCAN message Error
112	*P2009	Variable Swirl Actuator Control Circuit Low(Bank 1)
113	*P2010	Variable Swirl Actuator Control Circuit High(Bank 1)
114	*P2015	Variable Swirl Actuator Position Sensor/Switch Circuit Range/Performance
115	*P2016	Variable Swirl Actuator Position Sensor/Switch Circuit Low
116	*P2017	Variable Swirl Actuator Position Sensor/Switch Circuit High
117	P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input
118	P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input
119	P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input
120	P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input

NO	P code	DESCRIPTION
121	P2138	Throttle/Pedal Position Sensor/Switch “D” / “E” Voltage Correlation
122	P2228	Barometric Pressure Circuit Low Input
123	P2229	Barometric Pressure Circuit High Input
124	P2262	Turbocharger Boost Pressure Not Detected - Mechanical
125	P2263	Turbocharger Boost System Performance
126	P2264	Water in Fuel Sensor Circuit
127	*P2562	Turbocharger Boost Control Position Sensor "A" Circuit
128	*P2563	Turbocharger Boost Control Position Sensor "A" Circuit Range/Performance
129	*P2564	Turbocharger Boost Control Position Sensor "A" Circuit Low
130	*P2565	Turbocharger Boost Control Position Sensor "A" Circuit High
131	*P2566	Turbocharger Boost Control Position Sensor "A" Circuit Intermittent
132	U0001	High Speed CAN Communication Bus
133	U0100	Faults in CAN a Transmit Messages

*Pxxxx codes would be applied to only S250/220 models

CHAPTER 10
ANTI CORROSION SYSTEM



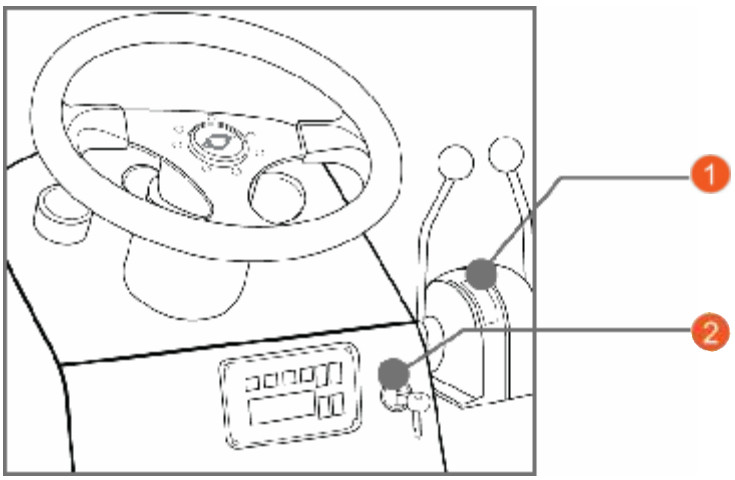
The sacrificial anode must be replaced when more than 60% of it has been used. Check especially frequently when used in saltwater. It is recommended to replace the sacrificial anode at the start of each season.

CAUTION

- **DON'T DRIVE IN THE ABSENCE OF ANODES. IT IS HARMFUL TO YOUR ENGINE.**
- **CLOSE THE SEAWATER VALVE BEFORE THIS MAINTEMANCE.**
- **MAKE SURE TO CHECK THE ANODE PLUG IN ACCORDANCE WITH THIS MANUAL; DON'T LOOSEN COOLANT DRAIN PLUG.**

CHAPTER 11
ENGINE OPERATION

1. ENGINE ON/OFF



1) Before starting the engine, you should check engine oil, coolant, gearbox oil, fuel gauge, raw water pump, battery, and so on.

2) When you start the engine, check that the engine throttle lever① is at neutral position. If not, the engine may not start or there is possibility of shooting off. Especially if your boat is equipped with a neutral safety lever, when the engine throttle lever is not at neutral position, you can't crank. You can also check this on the EOI.

3) After starting the engine, release the key② immediately to prevent damage to the start motor.

5) Avoid max. rpm and WOT (Wide Open Throttle) before the cold engine is fully warmed up.

6) At a cold start, it takes a few or more seconds to start the engine.

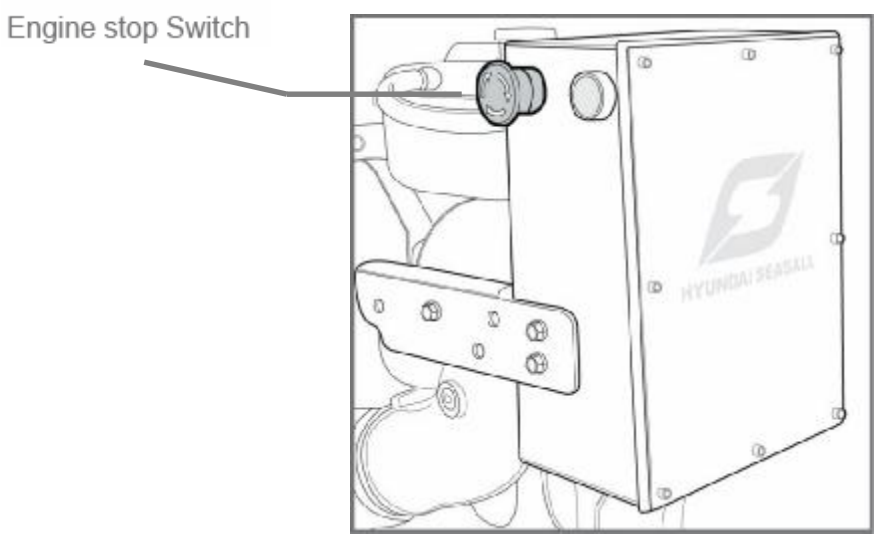
7) If the engine does not start in 10 seconds, release the key. After 10 seconds try again. This method can help avoid start-motor damage.

WARNING

DO NOT DRIVE IN SPACE WHERE THERE IS NO AIR CIRCULATION. EMISSION GAS IS HARMFUL.

2. EMERGENCY STOP

1) You can stop the engine by pushing this switch. After releasing the switch, you can start the engine again.
2) When the switch is pressed or it doesn't work normally, the engine doesn't crank. We recommend that you check this switch first if there is any cranking problem.
3) You can use this switch to avoid unexpected engine ignition during maintenance.
4) You can use this switch for any emergency situation.



3. WINTER OPERATION AND STORAGE

1) When using or storing your engine under 0˚C, protect all seawater passing parts (seawater pump, intercooler, heat exchanger) and line (seawater strainer, valve and pipe) from freezing. the sterndrive models especially should trim down fully to prevent trapped water in gear case from freezing.
2) The battery capacity decreases as the temperatures drop. We recommend recharging the battery frequently. Check and clean all battery cable connections, as oxidized connections lead to voltage drops and starting difficulties.

CHAPTER 12
ENGINE STORAGE

The major consideration in preparing your engine for storage is to protect it from rust, corrosion, and damage caused by freezing of trapped water.
The following storage procedures should be followed to prepare your engine for out-of-season storage or prolonged storage (two months or longer and winter storage) :

CHECK LIST
• Visual inspection for leaks and damage
• Change engine oil and oil filter
• Replace fuel filter
• Check air filter element and clean if necessary
• Check engine coolant level and top up if necessary
• Check impeller and replace if necessary
• Check anode and replace if necessary
• Clean the engine
• Flush and drain seawater cooling system
• Fill fuel tank until full and inspect the fuel system
• Remove the battery and store in a cool, dry place

CAUTION

FOR OVER-WINTERING, SEAWATER SHOULD BE DRAINED FULLY BY LOOSENNING HEAT EXCHAGER ANODE.
REFER TO CHAPTER 10.

CHAPTER 13
MAINTENANCE

1. PREDELIVERY INSPECTION CHECK LIST

1.1 BEFORE THE WATER TEST

-ENGINE CHECKS	Y	N
Seawater inlet valve open		
Engine coolant level		
Cooling system hose clamps tight		
Engine oil level		
Power steering fluid level		
Drive belt tension		
All electrical connections tight		
EOI warning system operating		
Battery fully charged and secured		
All fuel connection tight		
Exhaust system hose clamps tight		
Engine mount tight		
Engine alignment		
Correct rotation propeller (Installed and torque)		
Engine coolant and oil drain plug closed		
Throttle, shift and steering system fasteners tightened properly		

-PROPULSION CHECKS		
Stern drive unit oil level		
Power trim oil level (stern drives)		
Drive unit fasteners torque		
Power trim cylinders fasteners tight		
Propeller nut torque		
Transmission fluid level		

1.2 ON THE WATER TEST

-ENGINE CHECKS	Y	N
Boat drain plug in place (check before putting boat in water)		
Seawater pump operation		
Seawater strainer correctly mounted , Clean and tightly closed		
Engine alignment (propulsion only)		
Fuel leaks		
Oil leaks		
Coolant leaks		
Water leaks		
Exhaust leaks		
EOI and gauges operation		
Engine emergency stop switch operation		
Idle RPM, within specifications		
WOT RPM, within specifications (in forward gear)		

-PROPULSION CHECKS		
Steering operation throughout range		
Power trim operation (stern drives)		
Forward - Neutral - Reverse gear operation		

1.3 AFTER THE WATER TEST

Fuel, oil, coolant, water and fluid leaks		
Oil and fluid level		
Propeller nut torque		

2. MAINTENANCE SCHEDULE

Maintenance item / Maintenance intervals		Whichever comes first		
		Daily	200h / 1year	400h / 2years
Cooling system	Check the coolant level and leakage	●		
	Replace the seawater pump Impeller		●	
	Inspect the thermostat		●	
	Clean the pipe bundle of heat exchanger			●
	Check and clean the seawater strainer	●		
Exhaust system	Check the leakage	●		
	Replace the exhaust rubber bellows			●
Fuel system	Check the leakage	●		
	Replace the fuel filter		●	
	Replace the additional fuel filter		●	
Air intake system	Clean the air filter		●	
	Clean the pipe bundle of inter-cooler			●
Lubrication system	Check the level and leakage	●		
	Change the engine oil and filter		●	
Electrical systems	Connection / contamination		●	
Anti corrosion system	Check the sacrificial anodes[1)]		●	
Driving belt	Check the belt conditions		●	
Battery	Check the operating voltage	●		
Check tightness of the bolts, nuts and other fasteners			●	
Check tightness and corrosion of hose clamps		●		
Steering system	Check the oil level and leakage	●		
Propulsion system[2)]	Check the level and leakage	●		

1) If corroded over 60%, replace it.
2) More detailed maintenance, follow manufacturer's specifications.

CAUTION

YOU SHOULD EXERCISE THE UTMOST CARE TO PREVENT ENGINE DAMAGE OR INJURY TO YOURSELF WHENEVER PERFORMING ANY MAINTENANCE.

3. MAINTENANCE LOG

DATE	MAINTENANCE PERFORMED	ENGINE HOURS

CHAPTER 14
TROUBLESHOOTING GUIDE

■ Starter motor does not crank the engine

Possible Causes	
•Engine stop switch “ON” position	•Engine is not shifted to neutral position •Wrong neutral switch connection to EOI
•Weak battery or battery connections are loose or corroded	•Starter motor solenoid or slave solenoid failure
•Ignition key switch failure	•Blown fuse at EOI
•Wiring or electrical connection fault	•Defective ECU

■ Engine cranks but does not start

Possible Causes	
•Weak battery or bad starter motor	•Low fuel pressure
•No fuel	•Low compression pressure
•ECU not functioning	•Crank position sensor not functioning
•Incorrect starting procedure	•Fuel is not reaching the engine
•Faulty fuel filter or electric fuel pump	•Bad fuel quality or water ingress in fuel
•Faulty fuse	•Faulty injector

■ Engine starts with difficulty or starts and stalls

Possible Causes	
•Low fuel pressure in fuel rail	•Not connected fuel return line at injector
•Leakage in high pressure fuel circuit	•Faulty alternator or voltage regulator
•Faulty fuse	•No engine coolant temperature sensor signal
•No rail pressure sensor signal	•Low battery voltage
•Oil level too high or too low	•Low compression pressure
•ECU program error or hardware fault	•Clogged fuel filter

■ Engine idle is rough

Possible Causes	
•Not connected fuel return line at injector	•Low compression pressure
•No rail pressure sensor signal	•Poor tightening of injector clamp
•Wiring harness open or poor connection	•Faulty high pressure fuel pump
•Bad fuel quality or water ingress in fuel	•Faulty injector
•Clogged fuel filter / air filter	•Carbon deposit on the injector

■ **Engine rattling, noisy engine**

Possible Causes	
•Compensation of individual injector not adapted	•No engine coolant temperature sensor signal
•Low compression pressure	•Clogged injector return line
•No rail pressure sensor signal	•Faulty injector
•Poor injector O-ring	•Carbon deposit on the injector

■ **Untimely acceleration / deceleration**

Possible Causes	
•Intermittent faulty fuel line connection	•Oil suction
•No rail pressure sensor signal	•ECU program error or hardware fault
•Leakage in intake system	•Damaged turbocharger or leakage in vacuum line
•Clogged fuel filter	•Low compression pressure
•Leakage in high pressure fuel circuit	•Injector needle stuck

■ **Engine stop**

Possible Causes	
•Run out of fuel	•Crank signals missing
•Not connected fuel feed line	•Fuel pressure regulator valve contaminated, stuck, jam-med
•Leakage in high pressure fuel circuit	•Rail pressure regulator valve contaminated, stuck, jam-med
•Fuel out of order	•Faulty alternator or voltage regulator
•Bad fuel quality or water ingress in fuel	•Faulty high/low pressure fuel pump
•Clogged low pressure fuel circuit	•ECU program error or hardware fault

■ **Performance loss**

Possible Causes	
•Compensation of individual injector not adapted	•Leakage at the injector
•Clogged air filter	•Fuel or intake air temperature too high
•Oil level too high or too low	•Engine coolant temperature too high
•Damaged turbocharger or intake air leakage	•Low compression pressure
•Clogged fuel filter	•Poor valve clearance

CHAPTER 15
WARRANTY

WHAT IS COVERED

Hyundai SeasAll warrants its new products to be free of defects in material and workmanship during the period described below.

DURATION OF COVERAGE

This Limited Warranty provides coverage for two (2) years from the date the product is first sold to a recreational use retail purchaser or when the Product has been operated for 1000 hours, whichever occurs first. This Limited Warranty provides coverage for one (1) year from the date the product is first sold to a commercial use retail purchaser or when the Product has been operated for 1000 hours, whichever occurs first. This limited warranty is transferable to a subsequent purchaser, but only for the remainder of the unused portion of the limited warranty. To transfer the warranty to the subsequent owner, send or fax a copy of the bill of sale or purchase agreement, new owner's information and engine serial number to Hyundai SeasAll's distributor or dealer. Upon processing the transfer of warranty, Hyundai SeasAll will send registration verification to the new owner of the product by mail.

WARRANTY REGISTRATION

Your selling dealer fills out the Warranty Registration Card and mails it to the distributor responsible for administering the warranty registration for your country. Warranty Registration must be made no later than 15 days from the date of sale after purchase from authorized dealer. The Warranty Registration Card identifies information on customer and product, models and serial numbers, date of sale, type of use and the selling dealer.

The distributor or dealer also certifies that you are the original purchaser and user of the product. A copy of the Warranty Registration Card, designated as the Purchaser's Copy, must be given to you immediately after the card has been completely filled out by the selling distributor or dealer.

This card represents your registration identification, and should be retained by you for future use when required. Should you ever require warranty service on this product, your dealer may ask you for the Warranty Registration Card to verify date of purchase and to use the information on the card to prepare the warranty claim forms.

CONDITIONS THAT MUST BE MET TO OBTAIN WARRANTY COVERAGE

Warranty coverage is available only to retail customers who purchase from a dealer authorized by Hyundai SeasAll to distribute the product in the country in which the sale occurred, and then only after the Hyundai SeasAll specified pre-delivery inspection process is completed and documented. Warranty coverage becomes available upon proper registration of the product by the authorized dealer. Routine maintenance outlined in the Installation and Operation Manual must be timely performed in order to obtain warranty coverage. Hyundai SeasAll reserves the right to make any warranty coverage contingent upon proof of proper maintenance.

WHAT HYUNDAI SeasAll WILL DO

Hyundai SeasAll will pay for all parts and labor needed to repair the damage to the product resulting from a defect in materials or factory workmanship.

The warranty does not apply to any damage or defect that is the result of abnormal use or carelessness.

The repair or replacement of parts, or the performance of service under this warranty does not extend the life of this warranty beyond its original expiration date.

OWNER'S OBLIGATIONS

It is the owner's obligation to install, operate, maintain and care for Hyundai SeasAll engines in accordance with the instruction and requirements stated in the Installation and Operation Manual.

The owner is responsible for providing enough time and cooperation to get the engine repaired by an authorized dealer, and to deliver it to a proper facility for repair.

The owner is responsible for the cost for warranty inspection, including landing, launching and transport.

HOW TO OBTAIN WARRANTY COVERAGE

The customer must provide Hyundai SeasAll with a reasonable opportunity to repair the engine, as well as reasonable access to the product for warranty service. Warranty claims shall be made to a Hyundai SeasAll Authorized Repair Facility to service the product. Purchaser shall not, unless requested by Hyundai SeasAll, ship the product or parts of the product directly to Hyundai SeasAll. The warranty registration card is the only valid registration identification and must be presented to the dealer at the time warranty service is requested in order to obtain coverage.

LIMITATIONS – EXPENDABLE PARTS

• Filters : fuel filter, engine oil filter, air filter
• Engine oil and coolant
• Rubber products : seawater pump impeller, rubber hoses, belt
• Gaskets, anode, thermostat

WHAT IS NOT COVERED

• Fuel injector or filter cleaning
• belt or control adjustments or lubrication checks made in connection with normal services.
• Damage caused by neglect, lack of maintenance, accidents, abnormal operation, improper installation or service, or freezing temperatures.
• Haul-out, launch or towing charges; removal and/or replacement of boat partitions or material for necessary access to the product when such service is due to boat design; all related transportation charges and/or travel time, etc.
• All incidental and/or consequential damages (storage charges, telephone or rental charges of any type, inconvenience or loss of time or income) are the owner's responsibility.
• Use of other than Hyundai SeasAll genuine replacement parts when making warranty repairs.
• Participating in or preparing for racing or other competitive activity.
• Water entering the engine via the air inlet filter or exhaust system or submersion. Also, water in the starter motor.
• Failure of any parts caused by lack of cooling water.
• Use of fuels and lubricants that are not suitable for use with or on the product. Please refer to Installation and Operation Manual.

TRANSMISSION AND STERNDRIVE WARRANTIES

The ZF Marine Transmissions and CMD Diesel Sterndrive Bravo Models are covered under separate warranties, and serviced by those companies. For information on those warranties, please see the separate booklets included in the original packaging of your Hyundai SeasAll purchase.

Date of sale / Warranty Transfer ☐

Month	Day	Year

Please fill out the following registration card in English.

Owner's Information

Name/Company		ZIP Code/Post Code	
Street/P.O. Box			
City		State/Province	
Country		E-Mail	
Telephone		Mobile Phone	

Dealer Information

Dealer Name		Dealer Code	
City		State/Province	
Country		E-Mail	
Telephone		Mobile Phone	

Engine Information

Number of Engines	Single ☐ Dual ☐		
Engine Model		Gear Model	
Engine Serial No.		Gear Serial No.	
		Transom Serial No.	
Engine Model		Gear Model	
Engine Serial No.		Gear Serial No.	
		Transom Serial No.	

Boat Information

Repower ☐

Manufacturer		Material	Steel ☐ Alu. ☐ FRP ☐ Wood ☐		
Model		LOA	ft	Beam	ft
Boat Type		Hull ID			
Type of Use	Pleasure ☐ Commercial ☐	Planing ☐ Semi. ☐ Disp. ☐			

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ABSOLLUTE MARINE POWER

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